THE AMERICAN GAS LIGHT JOURNAL

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[Special Editorial Correspondence—by Telegraph.]

THE TWENTY-FOURTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

ST. LOUIS, MO., October 29, 1896.

Dear JOURNAL: Despite the exigencies that required the executives of the American Gas Light Association to put over for one week the dates for holding the 24th annual meeting, which exigencies were detailed at the time of their development in your columns, the officers and the members, and all others as well who participated in the present convention, have the satisfaction of knowing that the change worked not at all to the injury of the Association or to the retarding of its purposes. The meeting was an excellent one in every respect, as all will agree when the reports of the proceedings are conned. In the first place, the Association was particularly well served in the matter of weather conditions, the ruling light and temperature being those which glorify that season known to fame as perfect Indian summertime; the housing was all that any could hope for—the meeting room in the Planters' lacking but one thing, in that its accoustic properties were not of the best; the attendance was quite up to the mark in the matter of numbers and representativeness; the conduct of the meeting, from the point of view of the parliamentarian, was even, temperate and successful; the members were punctual and interested in their attendance; and the social side was prettily and unostentatiously managed by the local Reception Committee and the Committee of Arrangements. So much by way of prelude. The meeting was called to order by President Humphreys at the appointed hour on the morning of the 27th, and his reception was such as one might expect from a body of his fellow-craftsmen, who, in welcoming him to preside over their deliberations, well remembered his valuable services to the Association in the years gone by when he had done them long, capable and courageous labor as Secretary and Treasurer. The municipality of St. Louis did not see fit to send any official representative to welcome the Association, but as St. Louis is just now the center of as warm a political contest as was ever waged, this omission is readily explainable, for practical politicians have very little time at present for wooing commerce—the scalp of the "other fellow" is what each of them most desires. However, the Association did not seem to mind the lack of official municipal welcome, for the business to be considered was at once taken on. The first thing was the report of the Council in the instance of the applications for membership, and when it is said that the rolls were increased by the election of 32 new members (23 in the Active and 9 in the Associate class), I think it was sufficiently well shown that the Association goes into its 25th year in vigor and with promise of increasing usefulness. The regular annual report of the Council next claimed attention, and some of its lines attracted more than ordinary attention. Having passed upon the desirability of the papers to be read, the Committee reported that it was constrained to accept the resignation of Mr. Irvin Butterworth from the position of First Vice-President of the Association, a position that virtually insured to its occupier the place of President in 1897. The Council well said, in respect of his declination, that it believed it expressed "the sentiments of the Association in communicating to Mr. Butterworth its regrets that he should deem such resignation advisable." I am not at liberty (if in fact I really know them) to descant upon the reasons that were under Mr. Butterworth's determination, but I do say—and I know full well in so saying I voice the JOURNAL'S thoughts in respect thereto—it is to be regretted that he declined to go on to the end, for his course has been such as to command confidence and respect. The other marked lines in the Council's report were tuned to happier measure, in that they recommended the election of Commissioner Forrest E. Barker to honorary membership.

It is needless to say that the able, fair-minded Chairman of the Massachusetts Board of Gas and Electric Light Commissioners, deserved this promotion; and it is also needless to add that he appreciated to the full the kindly recognition by the Association of his straightforward course. The report of the Secretary showed that the Association's rolls were strong, and also that death had been merciful in the year, the mortuary table holding but one name, that of Mr. W. H. Townsend, whose shockingly sudden death was reported shortly after the close of the meeting last year. The Treasurer's report was reassuring, in that it showed the Association to be the possessor of a comfortable cash balance. Next came the report of the Committee on Education and Research, and that it had well-attended to its duties was well proved by the statement that 76 budding gas men had seen fit to enter themselves in the "Instruction Class." This is really a wonderful result to record in the short space of one year, and the Committee is to be heartily con-

gratulated over the singleness of purpose that has marked its work. Then came the report of the Committee on Standards, who had not much of success to chronicle; not because of its lack of diligence, but rather from the inattention of the members in general to the work that it sought to accomplish. The Nominating Committee then handed in the list of office-bearers, as follows:

President—C. H. Nettleton, Derby, Conn.
First Vice-President—J. B. Crockett, San Franciso, Cal.
Second Vice-President—A. C. Humphreys, New York city.
Third Vice President—G. G. Ramsdell, Phila., Pa.
Secretary and Treasurer—A. E. Forstall, Newark, N. J.
Members of Council to Serve Two Years—J. A. P. Crisfield, Robert Young, B. E. Chollar and W. R. Beal.

Of course, the gentlemen named were elected. The list, too, showed that Mr. A. B. Slater, Jr., had adhered to his determination, avowed last year at the Philadelphia meeting, to retire from the position of Secretary and Treasurer at the end of the '96 term. For several years Mr. Slater served the Association in the capacity named, and it is not saying any too much about his record when it is said that he was remiss in nothing, that his best thought and sustained effort were for the benefit of the Association, and that the Association was greatly benefited thereby. Expanding business responsibilities only caused him to relinquish the duties of Secretary and Treasurer, and he takes with him in his retirement the goodwill and gratitude of the Association he so ably served.

The Secretary and Treasurer-elect, Mr. A. E. Forstall, a son of the late Mr. Theobald Forstall, an ex-President of the Association, is no novice in the gas business, nor is he unacquainted with that which goes to make a Secretary successful. Indeed, he is a most worthy successor of his predecessor, and that is saying all that could be said. It was regrettable that Mr. Forstall could not attend the meeting, but he did respond by wire, from Newark, in the shape of a felicitous message announcing his acceptance of the duties imposed upon him by the Association.

The election over, the Association listened to President Humphreys' address.[1] Of course, it was scholarly; certainly it was received with satisfaction. I will not attempt any criticism of it here, knowing that it will come in for attention later on at the JOURNAL'S hands. The afternoon of the first day was principally occupied by the reading of and discussion on Mr. Nettleton's excellent paper, entitled "A Discussion of the Methods Employed in Introducing Gas Stoves." Of course, it was in the Derby man's most careful and certain vein, and the discussion it brought out will be as well worth reading as it was interesting to listen to. The Committee of Arrangements had carriages in waiting for the ladies—they were all too few this time—and in the evening a most enjoyable informal reception was held in the hotel. The second day was quite like the first, in that the technical part of the proceedings was of marked interest. The set papers were thoroughly discussed, and the paper list was further enhanced by short papers on several subjects intended to lead to useful comment. The contributors were Messrs. C. W. Blodget, T. Littlehales, A. C. Humphreys, A. B. Slater, Jr., and A. E. Forstall, and their lines certainly started the members to ask questions that were many and varied. The Question Box, too, was prolific of matter worth sifting. So the meeting from the purpose proper of the Association left nothing to be desired. The afternoon session of the second day was held in the Directors' room of the Laclede Gas Company, for the hotel folks desired possession of the "Ladies' Ordinary" in the Planters', to arrange for the banquet tendered the Association by the Laclede Gas Company. Quite a spirited debate over the next place of meeting was brought off. The Committee recommended New York city, but when the discussion was at an end the Association declared in favor of Fortress Monroe. The social features of the entertainment for the second day included a trolley party, starting from 6th and Locust streets, a matinee visit to Mansfield, who was doing his best as "Beau Brummel," and at night a look in on Seabrooke, who made a most laughable "Thoroughbred"—of course, it is understood that these social features were only participated in by the weaker sex. The banquet was complete in every sense. The menu was excellent, the fare was delicious, the toastmaster Capt. W. H. White, was in his best vein; the guests were harmonious—what more could be said. The city was represented at the festive board by Mayor Cyrus P. Walbridge, and his remarks, responding to the toast, "The City of St. Louis" were eloquent, witty and wise. Several other excellent responses were made to the toast list—the framing of which was a remarkably clever bit of work. To-day (Thursday) the programme includes drives to several points of interest in this city and suburbs, with a luncheon in the afternoon at the House of the St. Louis Jockey Club on the Fair Grounds. The weather looks threatening, with every indication that over our journey some rain must fall; but every one seems disposed to make the trip, rain or shine. Let me conclude this hasty resumè by stating that the meeting was in every respect a success.—C.

1. See JOURNAL, p. 684.

[ABSTRACT OF PROCEEDINGS.]

TWENTY-FOURTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE PLANTERS' HOTEL, ST. LOUIS, MO., OCTOBER 27, 28 AND 29, 1896.

FIRST DAY, OCTOBER 27—MORNING SESSION.

The President (Mr. C. J. R. Humphreys, of Lawrence, Mass,), called the meeting to order at 10:15 A.M. On motion, the reading of the minutes of the last meeting was dispensed with.

APPLICATIONS FOR AND ELECTIONS TO MEMBERSHIP.

The Secretary (Mr. A. B. Slater, Jr., Providence, R. I.), read the report of the Council in the matter of admission of new members, as follows:

ST. LOUIS, MO., October 27, 1896.

To the President and Members of the American Gas Light Association—Gentlemen: Your Council has approved the following applications for membership and submit them to you with the recommendation that they receive favorable action:

Active.

Miller, William A., Supt. of Manufacture, Cincinnati (O.) Gas Light and Coke Co.; Boardman, A. J., Manager Tampa (Fla.) Gas Co.; Brown, Rezeau B., Manager Market Street Works, Newark (N. J.) Gas Co.; Carpenter, Wm., President East Chester Gas Co., Mount Vernon, N. Y.; Cathels, Edmund, Supt. and Engr. Hamilton (Ont.) Gas Light Co.; Doty, Paul, Gen'l Manager Consolidated Gas Co. of New Jersey; Dole, Walter S., Supt. Equitable Gas Light Co. of New York City; Hatstat, John W., Supt. Hartford (Conn.) Gas Light Co.; Knowles, W. P., Supt. City Gas Works, Richmond, Va.; Learned, Charles A., Supt. and Manager Meriden (Conn.) Gas Light Co.; Lloyd, John, Prest. Altoona (Pa.) Gas Co.; Doherty, Henry L., Gen'l Manager Madison (Wis.) Gas and Electric Co.; Norcross, J. Arnold, Consulting Engineer Derby (Conn.) Gas Co.; Page, F. D., Supt. Fitchburg (Mass.) Gas and Electric Light Co.; Poor, Frank B., Pres. Hackensack (N. J.) Gas and Electric Co.; Porter, J. F., Pres. Alton (Ills.) Gas and Electric Co.; Ross, Alexander, Sec. and Gen'l Manager Laclede Gas Light Co., St. Louis, Mo.; Schniewind, F., Supt. United Coke and Gas Co., Pittsburgh, Pa.; Slater, Howard C., Supt. Milwaukee (Wis.) Gas Light Co.; Wilcox, John F., Manager United Coke and Gas Co., Pittsburgh, Pa.; Wood, Richard, Supt. Santiago (Cuba) Gas Co.; Wortendyke, Ira F., Supt. New Gas Light Co., Janesville, Wis.; Stacey, James E., Gen'l Manager Florence (Ala.) Gas Co.

Associate.

Dougherty, H.N., General Salesman for Farrell, Logan & Son, Brooklyn, E.D., N.Y.; Eaton, Alfred B., Asst. Sales Agent of the United Gas Improvement Co., Chicago, Ills.; Henderson, E. H., Sales Agent for James Gardner, Jr., Pittsburgh, Pa.; Hinman, Charles W., Manager for Nathaniel Tufts Meter Co., Boston, Mass.; Nichols, J. O., Treasurer of Shaner Coal Co., Philadelphia, Pa.; Platt, E. S., Secretary and Treasurer of George Platt & Co., St. Louis, Mo.; Roper, George D., President and Manager of Eclipse Gas Stove Co., Rockford, Ills.; Van Wie, E. G., Manager Gas Appliance Department Detroit Stove Works, Detroit, Mich.; Wells, Fred. M., Chicago, Ills.

Number of applications—Active		23
" " Associate		9
Total new	32	
For transfer	2	
		34

Respectfully submitted, for the Council,
A. B. SLATER, JR., Sec. C. J. R. HUMPHREYS, President.

On motion of Mr. E. G. Pratt, the Secretary cast the ballot of the Association for the election of the named applicants, Mr. Geo. T. Thompson acting as teller. The President then introduced the new members to the convention.

REPORT OF COUNCIL ON MANAGEMENT OF ASSOCIATION.

The following report from the Council respecting the management of the Association for the past year was then read:

To the Members of the Association:

Gentlemen—Your Council has the honor to make its annual report, as follows:

The separate report for applications for membership recommends the election of 32 applicants.

Upon the payment of arrears of dues, Mr. David Douglas has been reinstated to full active membership.

The resignations of four active and of three associate members have been received and accepted.

Your Council is sorry to be also obliged to report that 14 names have been removed from the roll of membership because of the non-payment of dues.

The following list of papers has been approved to be read at this meeting:

"A Discussion of the Methods Employed in Introducing Gas Stoves," by Charles H. Nettleton, Derby, Conn.

"Some Experiments on Internal Illumination," by Carter H. Page, Jr., Philadelphia, Pa.

"Inclined Retorts up to Date," by Frederick Egner, Norfolk, Va.

"A Modern Retort House," by Wm. A. Miller, Cincinnati, O.

"The Separation of Water Gas Tar," by Alten S. Miller, Long Island City, N. Y.

The First Vice-President, Mr. Irvin Butterworth, tendered his resignation from office, which was accepted after Mr. Butterworth had been further consulted; and your Council believes that it expresses the sentiments of the Association in communicating to Mr. Butterworth its regrets that he should deem such resignation advisable.

Your Council respectfully recommends for election to honorary membership in this Association, Mr. Forrest E. Barker, a member of the State Board of Gas and Electric Light Commissioners of Massachusetts.

The Council further respectfully recommends the adoption of the amendment[1] to the Constitution as specified in the report of the Committee on Applications for Membership.

Your Council, having received a communication from Mr. E. C. Brown, requesting that a representative of the Association be named as its Commissioner in connection with the proposed New York Gas Exhibit, and having received satisfactory information concerning said exhibit, has named your President, Mr. C. J. R. Humphreys to be such Commissioner or representative of the Association.

All of which is respectfully submitted by your Council.

C. J. R. Humphreys, President.

A. B. Slater, Jr., Secretary.

Mr. Forrest E. Barker was then elected to Honorary Membership, in accordance with the recommendation of Council. On being formally introduced to the Association, the Commissioner acknowledged the honor conferred upon him in his usual happy way. President Humphreys was named to represent the Association at the proposed Gas Industries Exhibition, to be held in New York in 1897.

Report of Secretary.

The Secretary's report showed the following:

Membership report of Secretary for year ending September 30, 1896:

Honorary Members.

On roll October 1, 1895		6
No change, on roll September 30, 1896		6

Active Members.

On roll October 1, 1895	365	
Elected October 16, 1895	13	
Reinstated, October 16, 1895	1	
		384
Dropped October 16, 1895	12	
Resigned during the year	4	
		16
On roll September 30, 1896		368

Associate Members.

On roll October 1, 1895	60	
Elected October 16, 1895	4	
		64
Dropped October 16, 1895	5	
Resigned during the year	3	
Died during the year	1	
		9
On roll September 30, 1896		55
Total membership September 30, 1896		429

Deceased—Associate Member, W. H. Townsend, New York City, February 26, 1896.

Resigned—Active, T. R. Brown, Phila., Pa.; C. E. Booth, Chicago, Ills.; J. G. Parkhurst, Coldwater, Mich.; V. S. Watrous, Little Falls, N. Y. Associate, H. M. Hubbard, Chicago, Ills.; John Whitehead, New York City; F. B. Rice, New York City.

Dropped—For list, see Vol. XII., No. 4 (Whole No. 18), page 296. On that list the 3d, 11th, 15th, 16th and 17th were Associates.

Respectfully submitted by

A. B. Slater, Secretary.

Providence, R. I., September 30, 1896.

Report of Treasurer.

The Treasurer's report showed a total receipt, for the year ended Sept. 30, 1896, of $2,327.90, an expenditure of $2,354.23, and a balance of $478.51. The report and accounts, which were formally attested by the Finance Committee, were received and ordered on file.

Report of Committee on Education and Research.

Mr. Walton Clark, as Chairman of the Committee on Research, read an interesting report of what had been accomplished during the year by the Committee. On motion of Mr. Vanderpool the expenses of the Committee were ordered to be paid by the Association.

Report of Committee on Standards.

Mr. Irvin Butterworth read the following report from the Committee on Standards:

Your committee have, for various reasons, been unable to go very exhaustively into the subject assigned to our consideration, viz.: "What, if any, further standards for gas apparatus and appliances should be adopted by this Association?" We have, however, given the matter considerable investigation, and our conclusions are as follows:

We find that the putting into practical use by gas companies of such standards as have already been adopted by our Association, has not been sufficiently general to encourage the belief that any further standards would be generally adopted, except possibly for purposes of discussion and comparison, and as a basis to work from in making plans or drawing specifications. For instance, we doubt if many of us even remember that, in 1880 and 1881, this Association adopted certain standards, covering such points as the terms in which gas production should be stated in papers and discussions, the number of pounds to a ton of coal, the number of cubic inches in a bushel of coke, also in a bushel of lime; the number of cubic inches in a gallon, a standard photometer burner, etc. In 1888-9, the Association also adopted standard meter unions, which one of the most enthusiastic gentlemen favoring such adoption now admits have not been put into general use by the gas companies represented in our Association, although he maintains that they are gradually doing so, and that the partial adoption so far has been very beneficial. In 1892 the Society of Gas Lighting adopted standards for cast iron pipes and gas works specials. The Chairman of the Committee which had the matter in charge, informs us that a "majority" of the gas companies represented in the Society have adopted these standards, indicating that their adoption is not yet general. He also says that the pipe foundries are very slow in making the change from the old style of castings.

Nevertheless, your Committee believe that the adoption of further standards by our Association would gradually conduce to uniformity in gas works apparatus and practice throughout the country, resulting in added convenience and economy in the conduct of our business. But we believe that such standards should only be determined upon and adopted after thorough scientific study and experiment, such as this Committee have been unable to make, and by practical and scientific men, who will also consider the money side of the subject and the interests of the large manufacturers who supply the needs of our industry. We, therefore, suggest that the further consideration of the subject of standards be referred to our standing Committee on Research, as it seems to us that this matter properly comes within the scope of that Committee's work.

If such reference is made, we would recommend that the Committee on Research consider and report upon the following matters:

1. Whether the standards for cast iron pipe, bell and spigot ends, three and four-way branches, reducers, drip-pots and plugs, as adopted by the Society of Gas Lighting, in 1892, and some of which were adopted by the Pacific Coast Gas Association at its last meeting, are suitable for adoption by this Association.

2. The adoption by this Association of the United States standard gauge for sheet and plate iron and steel, which gauge was established by Congress in 1893, and has been adopted by the various important engineering societies of the country.

3. The adoption of standards for house piping. In this connection we will say that, when this Committee was appointed, this subject was rather specially assigned to us, indicating an impression that standards for house piping are desirable, in which impression we share. We,

1. This clause was held over for further consideration, or until the receipt of the reports referred to.—Eds. A. G. L. J.

however, obtained from 41 representative gas companies throughout the country their rules governing the piping of buildings for gas, and find that the great majority of them are still following the schedule of sizes and lengths of pipes, and number of burners allowed, that is recommended in "King's Treatise," and that has been in use in this country for at least 30 years. This indicates that, with the great majority of gas companies, this schedule is giving satisfaction; but we note that many of the companies, especially those operating in high latitudes or making heavy water gas, have found it advisable to adopt rules requiring larger sizes and shorter lengths of pipes and fewer burners than are called for in the schedule referred to. We therefore believe that no standards can be adopted for house piping that will be exactly adapted to all companies and to all locations.

We recommend that if any further standards are adopted by this Association, the Secretary be instructed to publish from time to time, as such standards are adopted or existing standards changed, a pamphlet describing and illustrating such standards, and that copies of such pamphlet be furnished to members and others upon the payment of a proper charge to defray the expense of such publication.

Respectfully submitted, IRVIN BUTTERWORTH, Chairman,
A. B. SLATER, JR.,
W. R. ADDICKS,
Committee on Standards.

The Committee was discharged, and it was resolved that the further consideration of the matter of standards be referred to the Committee on Education and Research.

ELECTION OF OFFICERS.

Mr. Eugene Vanderpool, as Chairman of the Committee on Nominations, reported that the Committee recommended the following gentlemen to act in the positions named for the ensuing year:

President—C. H. Nettleton, Derby, Conn.
First Vice-President—J. B. Crockett, San Francisco, Cal.
Second Vice-President—A. C. Humphreys, New York City.
Third Vice-President—G. G. Ramsdell, Philadelphia, Pa.
Secretary and Treasurer—A. E. Forstall, Newark, N. J.
Members of Council to Serve Two Years—J. A. P. Crisfield, Robert Young, B. E. Chollar and W. R. Beal.

The Secretary having cast the ballot of the Association for the election of the gentlemen named, they were declared the officers for the ensuing year. Mr. Nettleton, on being introduced as the President-elect, accepted the position and its honors in a well put, appreciative speech. Later on Mr. Forstall (who was unable to be present at the meeting) telegraphed his acceptance and acknowledgments.

PRESIDENT'S ADDRESS.

The President then read the following address:

Once again the changing seasons, the blending of the autumnal foliage with the slow departing hues of summer, bring to us the privilege of meeting in annual conference, and reaping the full measure of these our yearly meetings. Mine is the privilege and pleasure—thanks to your kind indulgence and consideration—of calling to order this our 24th annual conference, and it certainly is an honor of which any gas engineer may justly feel proud, to preside, even for one brief spell, over the deliberations of his professional brethren gathered from the four corners of the continent. And yours is the duty—and I know it will be your pleasure—to make a success of this meeting, which lacks but one brief twelvemonth of marking the first quarter of a century of our history. Yours and mine is the pleasure to renew old friendships formed, if you please, in the early years of our Association's life, and cemented by these our yearly meetings, and to blend into closer friendships the acquaintances of more recent years. Yours and mine is the privilege to be mutual partakers at the fountain of our common knowledge and our common experience, and then go our respective ways to our daily tasks, refreshed by the memories of the kindly greetings which here have been our share, and strengthened and edified by the interchange of our common knowledge and our mutual experiences.

Surely, certainly, we mutually mourn over our lengthening necrology. We temper our sorrow by the thought that but one name has been added this year to the list of our departed comrades. Many friends will have a kindly remembrance of Mr. Wilbur H. Townsend; his geniality and kindly manner will be held in warmest memory.

Occasionally, very generally perhaps I should say, you will find a presidential address devoted to a happy review of all that has gone to make gas history throughout the year, but I wish not to be bounded today by any such restrictions; much would I prefer to wander where I would and speak of those matters which are uppermost in my mind. And if I should deal with administrative matters rather than with engineering problems, it is because I feel many of the important gas questions of the day belong to the administrative department. Surely the present, the ever living present, claims the first place in our thoughts, these troublous times in which we live. Ours it is not to deal here with the why or wherefore of these dark days. Here we know no tariff issues or moneyed questions, and could do no more in this regard than offer our protests when we see invested interests assailed, but ours it is to study the sailing of our ship amid the tempestuous waters, even though we may not ask what makes the waves so high.

And what are the peculiar conditions which surround us in these days? In general a contracted output, on account of the mills and shops being closed, an arrestation of the growth of business which has been ours of late years. Many companies situated in manufacturing districts have suffered in a double way; directly, by the closing down of mills and shops, which has perhaps cut off at one stroke a goodly share of business, and secondly, and indirectly, by the curtailment in output which has come from the desire of all to reduce expenditures. Such companies have had brought home to them a danger incident to large customers, and the lesson, if we would try to learn it, would seem to be to make the article we manufacture as indispensable as possible to as large a number of persons as possible. We must take a very broad view of this subject, and perhaps go somewhat far afield in studying the present-day conditions which do now beset our business.

It is generally held, and rightly, that gas companies are conservatively managed, and occasionally this remark is made as a token of reproach as if the conservatism was carried to an extreme. I do not think the charge is merited or deserved, and I think it behooves us to see to it that for the time to come we preserve the even tenor of our ways, but in avoiding the Scylla of extreme progressivism, we be careful not to drift on the Charybdis of ultra conservatism. We must see to it that we study carefully the spirit of the times in which we live and endeavor, as far as we may, consistently with the regard which we must exercise toward the properties we administer, to meet the important question of the day.

We should not unduly trouble ourselves with demands which we think to be unjust and unfair, but we may well pause for meditation, to recast the present status of our business and to make certain that in our efforts to be safe, sure and conservative, we do not get out of touch with the spirit of the times. In the main, old anchor grounds *may* be *well* enough for the present as for the olden time, but because they *were* safe in times gone by, it does not follow, *per se*, that nothing better offers to-day. Time, which is so prone to make, changes, may have left a sand bar, which would make the old ground not all we might wish for, or may have thrown an obstruction across the harbor outlet, which would increase the difficulty of getting to the open. Therefore, I would say, in studying the problems of the day, consider the times in which we live and hold fast to that which is good, if you please, but make sure that it is good—good to-day. Let us not hold to any given line of action, simply because we have ever done so, but let it be a subject for studious thought, and decide that it is good, if good it be, because, all things considered, it is in keeping with the times, and not merely good because it has been the rule in the past.

These thoughts lead me to say a word in regard to the selling price of gas and capitalization and their mutual relation. That a small fixed charge for dividend, that is, a low capitalization per unit of business, opens the way for selling gas at a minimum rate, cannot be gainsaid, and sometimes it is argued the selling price should be so adjusted as to enable plant extensions to be made out of current revenue. This is a conservative practice, but we must examine the question in its bearing upon the present generation as well as that to come. In fixing the selling price of any commodity, be it gas or be it what it may, due regard must be had to include in that rate a proper charge for keeping up a plant in good order; but it must also be borne in mind that when we go beyond, when extensive plant enlargements are made from revenue, the effect is to ask this generation to bear a burden for the benefit of those to come, and this is one of the problems we must consider in the light of the present day temper, and not follow any course simply because it has been past practice; for should we follow too conservative a rule in this regard, it might come about that, though the total of capital account remained the same, the capital per unit of business done might increase. And, really, the crucial test is, the capital investment per thousand feet of gas sold. I care not how much a company may increase its capital year by year. I care not if the figures swell year by year, provided that new business acquired may be fairly considered permanent, and provided further that new business increases in a greater ratio than the capital, so that the investment per thousand feet of gas sold is reduced year by year.

Turn with me, if you will, to "Field's Analysis" of the London Gas Companies' accounts, and make some comparison in the figures of the last ten years, and we will find in that time The Gas Light and Coke Company has increased its capital by some $7,000,000, but has reduced its capital per ton of coal carbonized by $2.25, while the investment per thousand feet sold has fallen 21 cents; and yet during that time the price of gas has been reduced and the profits have increased by 1 per cent. on the capital employed. The South Metropolitan shows a yet greater proportionate increase in capital, the advance being from $11,675,840 to $16,950,000—due doubtless in part to the construction of new stations—something over $5,000,000; yet the investment per ton of coal has fallen $1.50, while the figure per thousand feet sold is 23 cents to the good. The price of gas has fallen somewhat, and the profits show a small gain, 12-100 of 1 per cent. If we pass out of the city proper and turn our attention to ten of the suburban London Companies, whose figures of ten years ago, as well as of to-day, are available, we will find an increase in capitalization of $5,000,000, while the investment per ton of coal carbonized has decreased by $3, and the rate per thousand feet sold is 30 cents to the good. The profits show an increase of 12-100 of 1 per cent. I happen to have before me the remarks of the Chairman of the South Metropolitan Company, made at the half-yearly meeting of the stockholders some three years ago. He said: "The Company is increasing its capital account, half year by half year, in consequence of an increasing business. We are obliged to extend our works to meet the probable demand which has never failed us yet, and the failure of which we see no reason to anticipate. Of the amount expended of more than £50,000, £27,000 was for the extension of works, £12,000 for the extension of mains, £8,900 for new and additional meters, and £9,600 for stoves." Here we have a Company increasing its capital by $250,000 in six months and putting nearly $50,000 of that capital into gas stoves. Does this strike you as as radical? From "Field's Analysis" for the year of 1895 we may safely make the deduction that the London Gas Companies have a capital investment of $212 per consumer.

We may without much chance of error assume three gas stoves as equal to one consumer, and the cost of putting in a stove and a meter at $20, and assuming the customer uses sufficient gas for lighting to pay the interest on the service, we have the equivalent of a new consumer gained by an outlay of $60 capital against $212, and the rental of the stove as an additional income to be applied to depreciation of the stove, or as interest on the investment.

We may put it differently, and say that $50,000 would purchase and set up 3,330 stoves, not charging in meters, but assuming customers will also use gas for lighting, representing a consumption of, say, 66 million feet of gas per annum.

I have dwelt rather fully upon this one incident, in order that I might use it to raise the point that we must approach the question of proper capital charges in a very broad way and in a receptive frame of mind, not tied down too closely by old traditions, but ready to consider such problems from all possible standpoints.

Let us turn to some more recent records—as, for instance, the half-yearly meeting of the Gas Light and Coke Company of London, held this fall, where in the report to the stockholders we read of the following expenditures directly charged to capital account:

Mains and services	£24,990
Meters	45,096
Stoves	14,519
Land, including law charges	36
Buildings and machinery	33,228
Total for six months	£117,869

In the report we also read this item:

"In order to provide for the expenditure necessary for an extension of automatic meter supplies and the general increased demand for gas, the Directors will apply to the proprietors for authority to create and issue ordinary 'A' stock to the further amount of £150,000."

If we study the accounts of the South Metropolitan Company, of London, issued also for the six months ending last June, we will find capital account increased for the six months by the following charges:

Buildings and machinery	£1,898
Mains and services	19,147
Meters	18,489
Stoves	22,887
In all	£62,421

Here we see an increase of capital to the extent of $300,000 for one six months, all spent, it might be said, for securing new business.

True, these are not large amounts when figured on the capital stock of the companies in question, but nevertheless it emphasizes the point I have endeavored to make, that not only mains and meters, but gas stoves, are regarded abroad as a proper charge on capital; and by following out this scheme—this willingness to increase capital account for the purpose of obtaining new business—the investment per unit of business has decreased.

Let me quote from the proceedings of the meeting of another London Gas Company—the Crystal Palace—their last half-yearly meeting. The Chairman, Mr. George Livesey, speaking of the increase of business from prepayment meters, said: "It might be interesting to explain how the Company dealt with these automatic supplies. The meters and stoves were charged to capital, but the fitting up of the houses was being gradually repaid."

Here we have in these English cases instances of gas companies not merely charging to capital account the cost of gas stoves and meters, but actually issuing capital for the purpose; and in my judgment this is right and proper. Again I say, if we are to make our business as safe as may be from the effects of such troublous days as these, we must make our product as indispensable as possible to as large a number of persons as possible, and certainly the English companies are working on these lines. And I am strongly of the opinion that when we accept similar guidance for the conduct of our own business—when we are ready to regard moneys spent in extension of business as justly chargeable to capital—when we are ready to give up the idea that efforts in this direction must be governed by the funds in hand from revenue account, then in my opinion our business will grow as we would wish to see it; our capitalization per unit of business will decrease, and we will be more thoroughly in touch with the spirit of the times.

Again the question is raised, "Should experimentation have any place in a capital account? Should the cost of trying new machinery or new processes be charged to investment account?" Let us say at the outset, the management of a company should be expected to exercise due diligence and due thoughtfulness in considering the outlay of money on plant. This means they are required to avail themselves of the best advice attainable, and it also means, if it is incumbent on the management not to depart from standard methods except with good reason for success, so also does it require that timidity should not lead to the investment of money in antiquated apparatus. Supposing a company in the exercise of such due diligence invest in new methods for carrying out the manufacture or distribution of gas, and the same, proving a success, leads to the adoption of the scheme by other companies, and the subsequent cheapening of the cost of producing such plants, is such a company justified in carrying the plant at the book value? State Legislatures when considering the terms upon which a municipality should acquire a lighting plant often lay down the rule that a city should not pay for such experimentation. I cannot help thinking that such a narrow rule cannot but lead to stagnation in the gas business, for each corporation would wait to gain the benefit of another company's experiments, and no progress would be made. Such rules cannot but prevent the gas business from keeping up with the progress of the times.

Before taking leave of the question of capitalization, I desire to quote from that well-known work, "The Law Relating to Gas and Water Companies," by Michael and Will.

They say, "The question between the appropriation of capital and revenue, to which reference must again be made, ought to be and is, of the simplest kind. When works to be constructed are entirely new, that is, in excess of former existing works either of manufacture or distribution, the whole expense is rightly charged to capital; when in replacing and renewing old work, the new is more costly, more extensive or more capacious, such as replacing mains of one size with others of a larger caliber, then only the difference between the cost of the original work and the new must be so charged, and lastly the remainder as being maintenance and renewals, must appear charged under these heads; but when the new merely replaces the worn-out plant by producing exactly the same amount of accommodation, the whole expense must be found out of revenue." And I would call your particular attention to the wording as to replacing old work by new of greater capacity—that renewed shall be charged *only* with the difference in cost between the new and the cost, not *value*, but *cost* of the original work.

We need not break away from our old anchor ground just because it is old and the world is ever ready to worship the new, but let us carefully study our ground and see to it that the old position is not held so tenaciously that we find ourselves so hemmed in by the changes of time as to prevent our reaching the open, where we may safely look

for clear sailing. Still keeping in mind that the stability of our business rests largely on making the article we manufacture as indispensable as possible to as large a number of persons as possible, I would offer two other thoughts, and they are old ones: That we continue to give our customers a good light; that we use our utmost efforts in extending the use of gas for purposes other than lighting. These are old saws, you will say; yes, truly they are, but are they trite? They are certainly comprehensive and far reaching; for I said we should see to it that we give our customers a good light, therefore we have not fulfilled this obligation when we have merely manufactured an article capable of producing a good light, but the work must be carried along to the realization of that light, and that opens up the question of extending our influence, if not our control, to the point of the burner.

The introduction of the Welsbach light has been a help in this direction, as it has shown in a very striking way the possibilities of increasing the light by the use of gas, and at the same time decreasing the bill. This work, however, should not be left entirely to those who handle this new burner. Every gas company should maintain in its office test burners, good and bad, to give occular proof of the relation between the burner and the quality of the light, and, as further aids in this direction, recourse should be had to the distribution of brief printed matter bearing on the same theme, while efforts should be made to have new buildings at least so piped as to ensure a sufficiency of supply. You say you have grown discouraged in distributing printed matter, because much of it finds its way to the waste basket; we should not be deterred on this account, but rather remember the good which has come from efforts in this direction, and forgot not that truisms, if harped on persistently, will eventually bear fruit.

The second thought I offered, was extending the use of gas for other than lighting purposes. This is really as far-reaching a subject as extending our influence to the burner; and in the limited space which I can devote to these themes. I cannot bring before you anything new; in truth, I know full well of the earnest efforts put forth by gas companies in both these directions, and all that is necessary to-day is to urge that the good work be continued.

I need not touch upon exploiting the gas range, for that theme will be presented to you by an abler pen than mine, but I cannot refrain from saying that these thoughts bring to me with ever increasing force the necessity of every gas company having a sales or selling department, for the purpose of extending gas for all purposes and in every way. Much has been done in this direction by some companies of recent years, but we should all feel such a department is as necessary as the manufacturing department, the distributing department, or the bookkeepers' department. It must be remembered that he who is in charge of the selling of gas must be versed in the science of our business, must have the happy faculty of meeting people and impressing them favorably, and, at the same time, be a man of untiring industry and energy.

In connection with the problem of extending our business as far as possible, we cannot avoid saying a word about the subject of differential price of gas for fuel purposes. The question is, "How far is it wise and just to go in this direction?" I presume we must admit that that which is wise is not always just, and that that which is just is not always wise. Facts must sometimes outweigh theories, and thus it may not always be the part of wisdom to make such changes as are theoretically just, if it appears the public are not ready to study the matter at sufficient length to recognize the justice of the position taken. I think it well to treat this matter in two lights—justice and expediency. That there is much to be said in support of the argument, that gas for fuel purposes should not be charged with the full dividend or interest item, is generally conceded. A gas company must have an equipment equal to the maximum output in mid-winter, and must invest sufficient capital to secure the necessary plant to meet this requirement, and yet have, even under such circumstances, a proper margin for safety. And at this season of the year, at Christmastide, we will say the distributing plant will be utilized for lighting purposes about one-third of the 24 hours. Of course, some light will be required from an hour before midnight on, particularly in metropolitan cities; but regarding averages, the above will hold. Now, let us look at the ratio between maximum output and minimum business, and, as we are endeavoring to treat here of the lighting business alone, it will be safer to disregard recorded figures of relative outputs, which might introduce an error by including fuel business, and deal entirely with relative lighting hours at the different seasons of the year. We will, however, have to make some allowance for the fact that in summer much less gas is used per hour of darkness than in winter. In December the average lighting time, from dusk to 11 P.M., would be 6.75 hours; in June, 3.13 hours. Therefore, if 100 represent the output for lighting in December, the like figure for June would be 46; and if we designate the amount of dividend charge or interest per 1,000 feet by "d," then, having regard to this aspect of the case, the price charged for gas in June could *justly* be reduced by 54 per cent. of "d;" that is, by that proportion of the dividend or interest charge.

If, instead of taking the lighting hours as ending at 11 o'clock, we base our figures on the hours of darkness, our multiplier will be 41 instead of 54.

And here I give a table of the lighting hours by the month throughout the year. These figures I will not read in detail, but will merely note that if 100 represent the lighting hours to 11 o'clock for the month of December, then May would be represented by 52, June by 46, July 47, etc.

Table Showing Relative Length of Lighting Hours, from Dusk to 11 o'clock, Based on December as 100.

January	94	July	47
February	85	August	57
March	71	September	68
April	61	October	84
May	52	November	98
June	46	December	100

If we were to figure the lighting as all night, instead of from dusk to 11 o'clock, the table would be as follows:

Table Showing Relative Length of All-Night Lighting Hours, Based on December as 100.

January	97	July	60
February	90	August	70
March	82	September	77
April	71	October	89
May	63	November	95
June	59	December	100

From this table we gather that if 100 represent the hours of darkness for December, the corresponding figures for May would be 63; June, 59; July, 60, etc. Taking these two tables together, I would advance the thought that, having regard to this one aspect of the matter only, remembering that capital has to be laid out to take care of the maximum business in December, and that the bulk of the output for gas stoves comes in summer months, justly the price could be differentiated to the extent of 55 per cent. of "d;" that is, it could be reduced by 55 per cent. of the charge per thousand feet for dividend.

Fix the value of "d," and taking 55 per cent. thereof, you have a differential in favor of gas for cooking, which I think you may safely say is just; whether you can convince a large consumer of gas for lighting of this justice is another question. I think, however, it is worth the effort. There certainly is a business to be had—at prices—for purposes other than lighting. Would the taking of this business affect injuriously the gas *lighting* business? Each must decide for himself.

You have often heard the remark in railway circles in regard to fixing a tariff which the traffic will bear. You know railroads recognize that certain traffic can be had at a figure which would not, however, include its full proportion of fixed charges, and the profit on the business in question must be figured, not by deducting from the amount received per ton mile the operating and fixed charges per ton mile—for this would often be a minus quantity—but by considering only the operating charges per unit of measurement, or in many cases figuring only on the train charges per ton mile. The argument advanced for accepting freight on such terms is that, owing to geographical or other considerations, the business cannot be had at such a rate as would bear its full share of fixed charges, interest, salaries, etc., etc., and as these charges are not increased by the movement of the goods, therefore any fair return the traffic brings above the actual expense of train movement is so much to the good. I do not care to discuss at length this problem from the traffic manager's standpoint, more than to say that the argument is good to a certain point, and that just where the argument will break must be governed by the circumstances of the road; for when such special business bears an under-ratio to the total receipts, and the margin is small, then extreme caution must be observed, but my main point in bringing to your mind this well-known principle in traffic management is to direct your thoughts to a certain channel, to remind you that the gas companies are in a position to take certain business, if they are ready to disregard the refinements of justice and take what is offered at a figure which the business will bear. Justly, I

have said, we might differentiate to the extent of 55 per cent. of the dividend charges, but this will hardly be a sufficient concession to bring the large looked-for gain in output, so that it may be necessary to cut loose from the refinements of justice, and to fall back upon expediency, by not expecting the gas for summer fuel to bear its full theoretical proportion of distribution and office expense. It seems to me one of the important questions of the day is whether this business will be taken at a rate which the traffic will bear.

Will you bear with me a little further? The gas range would bring in a goodly business, but there is another source from which we might expect to increase our output even in a greater ratio, if we could afford to take the business—I mean house heating. Here we have a much more difficult problem to meet: First, because the demand from this source would come in the winter season, when the plant is already worked to its maximum—therefore I cannot establish a differential based in part upon considerations of justice; and, secondly, we must here figure against a greater efficiency in the duty of the coal which the gas must supplant. If you do not recall the actual figures—and I certainly am not going to look them up—you doubtless will at least remember being startled at the scientist's statement of the waste of energy in making a cup of coffee, and I have only to mention this to bring to your mind a picture of the heat units, carried out to the millions place, lost in every household coal range throughout the year. This low efficiency of coal as employed in domestic cooking is in favor of the gas range, but when we study the household heating problem we cannot find such comfort in the furnace or the boiler. Therefore we are doubly handicapped in seeking for this business.

What are the figures we must meet? They will vary certainly from climatic considerations; the colder the surroundings, the worse it is for gas. Let us treat of those localities where anthracite only is used for household work—that is, disregarding places situated as St. Louis is to-to-day, with bituminous coal at the back door. Generally the gas question is helped out by the charge for labor involved in caring for a coal heated furnace, thanks to the unwillingness of the kitchenmaid of the present day to undertake this coal shoveling. If you will figure the charge paid per season for such work, and divide by the number of tons of coal burned, you will, I think, find this item increases the cost of the coal by one-third; but even with this advantage, I think gas for house heating purposes still appears far off. From such data as I have been able to collect, and it is certainly very meager, I am inclined to the opinion that it will take 12,000 feet of gas to equal 1 ton of coal in household heating. I think, however, from my own experience in distributing steam heat, householders would be willing to pay something for getting rid of coal and ashes incident to a coal furnace; on the other hand, to obtain the result of 12,000 feet, the gas must be used economically and carefully. It would appear that such business would not bear its share of dividend charges. We could only look for a small advance over the cost of manufacture and distribution. It therefore becomes of prime importance in considering the question to keep in mind the ratio of present business to the capacity of the plant.

Frequently the capacity of a works is so far beyond present or apparent future needs that it might pay to obtain this scant margin. Frankly, I doubt if a figure can be made at this time which will secure the general use of gas in the house furnace, but it would be well for each manager to study the problem amid his own peculiar surroundings. Nor must we forget that the solution of the problem may be helped by the perfection of automatic appliances whereby the consumption of gas would be directly controlled by the temperature of the rooms heated.

As not altogether foreign to these thoughts, I would call your attention to the wisdom of work in the direction of utilizing to the full the *heating* value of the gas we supply. We show our customers the baneful effects of poor lighting burners, and have endeavored to show them the benefits of incandescent gas burners, and in years gone by have advocated the Siemens and the Lungren burners. Should we do less for the heating burner?

I have been very much interested lately in re-reading a paper by Prof. Lewes, read before The Gas Institute, at the '95 meeting, in which is detailed some experiments on the practical heating value of gas as compared with coal. The writer, after giving the thermal values and prices of the gas and coal, makes the deduction that, for equal thermal units, the coal is seven times cheaper than the gas, and of course follows with the statement that the salvation of gas in the contest can only come from the low efficiency of the coal and the high practical results of the gas. He says: "Any arguments based upon the thermal units which fuel is capable of developing, although of value as constituting a standard of comparison, are misleading and valueless when we come to apply them to everyday practice. A carefully constructed calorimeter may bear out your theoretical deductions, but your boiler and your fire grate certainly will not; and it seemed to me of the greatest possible importance to the gas industry that an attempt should be made to see what the ratio between coal gas and coal really is at the present time, and also to ascertain to what degree of efficiency our gas stoves have attained, and if possible to note the direction in which improvements should be made."

The author then goes on to describe his experiments, which were on the lines of heating a room of a cubical capacity of 3,032 feet, with different makes of gas stoves, then with a coal grate. Only one test was made a day, so as to allow the walls to attain a normal condition before starting another experiment. "The result given by the best stove was an increase in temperature of 6.5° F. in the first hour, and a total increase of 13° F. in five hours, for a gas consumption of 200 cubic feet in five hours, or an average of 40 feet per hour, which is equal to 1° F. rise of temperature for each 15.4 feet of gas, or, practically speaking, 2° F. for each pound of gas."

In contrast with these results we have his figures for heating the same room by coal burnt in an ordinary grate, and he summarizes the results as follows: "Under these conditions, therefore, 33 pounds of coal in a room give the same warming effect as 200 feet of gas, or 6.25 pounds. In other words, 1 pound of coal gas does the same heating as 5.6 pounds of coal—the gas costing 1d. and the coal a shade over ½d." These results do not appear very encouraging for gas; but let us follow the Professor a little further in his experiments. For, not content with these figures, he next turned to a gas stove of German origin. Will you bear with me while I quote again? He says: "Having obtained a large and small stove of this construction, I tested them under identically the same conditions as the English stoves. To my surprise I found that the efficiency was nearly 2½ times as great; the 200 cubic feet of gas consumed in the German stove giving a rise of temperature of 31° F., as against 13° F. yielded by the best English stove with the same consumption of gas. Comparing this with bituminous coal, we find that 80 cubic feet of gas, or 2½ pounds, are equal to 35 pounds of coal, or $\frac{1}{14}$ the weight. The coal, however, only costs $\frac{1}{70}$ the price of the same weight of coal gas. Making allowance for this difference, coal gas is substantially cheaper than coal burnt in the ordinary form of grate, when regenerative gas stoves are employed.

"The introduction of the regenerative principle for lighting purposes practically increases threefold the amount of light obtainable; and it would appear probably that, when properly applied for heating purposes, an increase nearly as great may be obtained."

Are you ready with the criticism that burning coal in a grate was handicapping the solid fuel? Truly. I would, however, remind you that the grate is the usual method of heating in England, therefore, the experiments were made under the conditions surrounding the gas managers of that country; the lesson for us to learn is this, that the heating value of the gas was increased 250 per cent., by adopting the regenerative gas stove, and secondly, that we should work along the lines here indicated, and make or have made for us practical tests on the relative heating value of gas and coal under the conditions which surround the gas managers of this country.

If it appears possible the efficiency of gas for heating may be increased by 250 per cent., is it not well to turn our thoughts for a moment to the efficiency of the gas range? And again I say I will keep away from the exploiting of the range, but ask you to consider the construction of the device. In what direction has the range been improved of late years? In thermal efficiency? I doubt it. In substitution of cast-iron for wrought—in making the parts largely interchangeable—in making the ovens so that they may be easily renewed when worn out? Yes. All this I grant, and these improvements are of great value as they greatly decrease the annual cost of repairs. Moreover, we see advancement made in the direction of conveniences of the stove, both large and small, and this is so much more to our good; but I doubt if the range of to-day will do a given work with a smaller gas consumption than would the stove of five years ago. Is it the fault of the manufacturer? I do not think so. We have asked the stove manufacturer, year by year, to add to his goods improvements and conveniences both large and small, those which are visible and so may help to sell the stove. At the same time we have insisted on the price of the article being reduced, and have made but few tests to determine the thermal efficiency of the burners. Let us now pause in our demands for the cheapening of the stove and ask for efficiency. Is it worth the effort? Am I far from the truth when I say that the stove manufacturer would be encouraged to greater effort in the direction of economy if you would *willingly* pay an extra cost of the stove equal to the price of 1,000 feet of gas you supply, and if he put this sum into the stove he

would eventually produce an article which would save—may we not say—2,000 feet of gas a year. If you think this to be a haphazard guess, take the figures home with you and work over them a little, and you may find them not far from the truth.

I have recently turned back somewhat the pages of history, and read with renewed interest the report of the English Smoke Abatement Exposition, of 1882. And I cannot but note the vital difference in the oven of the English gas stove then made, as compared with those manufactured in this country. I refer to the fact that in England the roasting and baking are done in one chamber, and the products of combustion pass around and about the viands, whereas in this country we are careful to use only those stoves wherein the roasting is accomplished by direct radiation from the gas flame, while an enclosed oven heated from the outside does the baking. I think it is also worthy of note that, as in 1882, the leading English stoves were made with an oven, so to-day, if we turn to the circulars of stove makers, if we read the advertisements in the gas papers published on the other side, we will see that the same principle holds. It has stood the test of time abroad. It would seem the single oven, with a row of jets at the bottom, wherein the heat of the products of combustion is utilized to the utmost, might be the more economical. In view of all this, would it not be well to turn anew to this problem and study it in the light of the days in which we live, when economies must be so carefully considered? You return the advice with thanks. You say you remember trying stoves of this class a quarter of a century ago with baneful results, and you say the public is prejudiced against any scheme which permits the products of combustion to come in contact with the food. I also can go back in memory to those days, or thereabouts, and while I am ready to admit that such prejudices did exist, I doubt if they have much force to day; and I bespeak for the whole problem of the efficiency of the gas stove, that you turn to it again and study it in the light we now possess, amid the conditions which now beset us. We must test all stoves carefully, and how shall the most of us do this? The larger gas companies can well afford to have such a working staff as will enable them to reach the facts in all such cases, but they are hardly willing to publish their results, not from selfishness, but because they dislike being led into disputes with the manufacturers. Can an Association like this undertake such work? Theoretically, yes; practically, no. We must look farther afield. Let a half-dozen medium sized companies join together to share the expense of testing the different stoves and use the results for their own guidance in selecting stoves, and I think they will have made a step in the direction of making gas as indispensable as possible to as large a number of persons as possible.

Of the many problems calling for the attention of the gas administrator few, if any, demand so fully his thoughtful study and careful consideration as the quality of the gas he should distribute, whether it should be of high or low candle power, or of such a grade as would be considered between the two. At first blush the proposition that we should distribute a gas of low candle power, one which it is claimed would be adaptable for both lighting and heating, seems very enticing, but the problem is too large a one to dispose of on the first blush. In another portion of my address I stated, if we wished to spread our wares so that they would be as far as possible indispensable to as large a number of persons as possible, then we should be very sure that we gave our customers a good light. Now, it is a grave question if we can give a good light with a poor gas; nor does it altogether meet the problem to say that the low candle gas is supplied cheaply. Many people want a good light, and do not feel their desires have been met if they have a poor light, even at a low figure.

A company often finds itself between the Scylla of fuel gas and the Charybdis of the electric light, and it certainly requires a steady hand and a cool head to safely steer the ship between these dangers. I would not touch upon the question of candle power vs. illumination, but I may say the electric light is a very bright light, the degree of incandescence is high, and I think that a large number of persons think they want such a bright light. We may argue against this demand to our heart's content, and claim and reiterate that it is not founded upon wisdom; but when we have exhausted our eloquence we will be likely to find the demand still existent; and experience would seem to show this competition is best met by a high grade gas, wherein the whiteness, brightness and smallness of the flame seem best to please this class of customers. On the other hand is the demand for cheap gas for fuel purposes. The problem has certainly become much simplified of recent years, as a portion at least of the public has absorbed the fact that a gas can vary in heating power as in luminosity, and that a producer gas, at an apparently low figure, may or may not be cheaper than one of good candle power. The fact that this lesson has been absorbed in part is encouraging. The question now confronting us is, "How can these two demands best be met?" It would hardly be profitable to consider this subject at great length, as local circumstances must largely govern each case, but it is well to bear in mind that candle power and heating value are closely related, and where the candle power may be added at small expense, it will sometimes be found that the higher gas is the cheaper per unit of heat as well as light. That the higher candle power gas does not find much favor for heating purposes is, I think, often due to the difficulty experienced in obtaining from such gas that same percentage of economy as the lower candle power gas gives; and there seems some ground for the contention that this is so, because we have not yet given ourselves in earnest to the subject of heating by high candle power gas and obtaining therefrom its proper percentage of economy. It will be well to study this question thoroughly, to make ourselves very familiar with the theoretical heating power of gases varying both in candle powers and constituent gases, before the gas lighting business is sacrificed by passing to a product of low candle power.

We stand sadly in need of experimental work on the heating power per candle power of gases of various constituents and of different candle powers. If we had such data it would be in order then to ascertain whether in a given locality heat could be the more cheaply supplied by gas of high or low degree. To-day we may guess at the answer, but I do not think we know very much about the problem.

I have some figures which are, I think, accurate as far as they go, but must needs be greatly amplified to serve us well.

Kind of Gas.	Candle Power.	Heat Units.	Heat Units per Candle Power.
Mixed gas.....	21.94	694.3	31.2
" "	24.45	721.5	30.
" "	24.72	714.5	29.
Water gas.....	26.82	710.9	27.
" "	28.19	734.9	26.96
" "	27.	730.8	27.05

To-day well nigh all gas works have a photometer for ascertaining the candle power of the gas made. We consider it an indispensable adjunct of our laboratory. We take the readings of the instrument systematically and in order. We watch what it says with care. It seems to me the day is not far distant—it seems to me the day is at hand—when we should place beside the photometer a calorimeter, to give us the heat units of the gas; that we should consider *it* an indispensable adjunct of our laboratory, that we should have *its* readings taken systematically and in order, that we should watch carefully what *it* has to say.

A few years ago, when the penny-in-the-slot machines first came into vogue—when the small boy, putting his coin into the machine, drew out its value of chocolate, when the maiden by the same procedure scented her handkerchief, and those of maturer age sought information as to their weight by the same means—we little thought of the field this same scheme would open up to the gas companies. Had we the prescience to turn our thoughts in this direction and to draw a vision of the possible increase of the business from this source, we would to-day be forced to admit that our wildest speculations have been surpassed by the experience of those companies who have worked out this scheme. In this connection I merely wish to refer to the proceedings of the half-yearly meetings of The Gas Light and Coke and South Metropolitan Gas Companies, as published in the *Journal of Gas Lighting*, of August 4th and 11th of the current year. I quote from the speech of the Governor of the largest gas company in the world. The report reads:

"He might mention that the average consumption per meter remained, as he informed the proprietors six months ago, at about 20,000 feet per annum; and he was therefore glad to be able to report a regular addition to these supplies week by week. The total number up to June last was just over 42,000, as against 11,000 in June, 1895, and there was on hand the first ultimo 6,500 applications, which they hoped to be able to comply with before the end of the current month."

I cannot say off-hand how many customers this Company had last June, but by referring to the last edition of "Field's Analysis," 1895, I find they had at that date 245,153 consumers. Take the report of the South Metropolitan Company, for the half-year ending June 30, and we find they set, during the six months, 7,142 of these prepayment meters, making their total for four years 50,091. Again referring to "Field's," I find the total customers of this Company 126,323. This opens up to us the possibilities in this direction. I wish I might give you some statistics from this side of the water, but I think the companies using these meters are feeling their way, and are not quite ready

to tell all they know on this theme. There is here at our command another means to carry out the suggestion I have offered—to make our product as indispensable as possible to as large a number of persons as possible. I would, however, recommend a company to move upon the territory slowly, unless it has a goodly cash reserve to so invest, or else is prepared to meet the expenditure as a capital investment.

As a further aid in studying the present days and taking thought for the future, let us glance at the progress made in the business during the last five years. I recently sent out inquiries to many of my professional friends touching the increase in the gas business during this time, and I am beholden to those who in many cases took a great deal of trouble in collecting figures for my use. I had hoped that I might be in a position to speak of the increase of gas sales for lighting and for fuel separately, and tell you what has been the ratio of gain in each department during the last five years; but so few companies kept separate records five years ago, it is difficult to arrive at any satisfactory figures in this regard. The figures which I would give you are mainly for the years of 1890 and '95, and I presume it must be accepted, regretfully, that they would not show up so well for the gas companies if they could have been brought up to the present date to include the contracted output of the last summer, during which the general stagnation of business so seriously affected lighting companies. I, however, have before me some figures which are particularly encouraging for the *gas lighting* business. They are from cities where natural gas has been introduced, thus taking from the gas company all their output for fuel purposes, and yet the sales have increased during the last five years. In one such case the gain has been 39 per cent., in another as high as 60 per cent., and yet again, where natural gas has taken the fuel business and the electric arc has replaced a large number of gas lamps, even so the output had advanced 7 per cent. Such figures are encouraging; they show the sterling vitality of the gas lighting business.

If we summarize the figures I have received, they show an average increase in business of about 30 per cent. in five years; this, in the face of the exploiting of the electric light and the status of business during this period, certainly shows a healthy condition of the industry. That the increase in the lighting and fuel departments differs greatly in the various cities and towns is what we should expect; but it is not possible to see that the results have been affected greatly by geographical considerations, other than the influence in certain sections of natural gas, and the variations in growth must be accounted for by local circumstances, and the personnel of the management. The possibilities of the fuel business are shown by recorded increases in this direction of 400 per cent., and in one instance over 1,000 per cent. increase in five years. Touching the proportion of output now used for fuel purposes, the figures would indicate that between 20 and 25 per cent. of present output is for fuel purposes, where special efforts have been made to push this part of the business. The greatest gain very naturally comes to those companies making a differential price for gas for fuel.

Thus, in a casual way, I have attempted to note a few of the problems which the gas administrator of the present day must solve. That I have said nothing new I grant; that the tale does not even possess novelty in the telling I grant; but I would that we should consider anew these problems that we may hold our old anchorage, if hold it we do, not merely because it has been our stamping-ground for years gone by, but because it is still our best and safest anchorage amid the conditions which now surround us.

Finally, I would say a word to you on Association matters. I will not discuss them at length, and for this reason. In recent years the Association has branched out into new and untried fields of labor and of usefulness, and it seems to me of prime importance that the Association should not undertake more than it has the strength to carry to a happy and successful fruition. Certainly the most important work the Association has undertaken of recent years is the task which it assigned to the Committee on Education and Research a year ago. That the education of the coming generation of gas workers—not the gas engineers alone, but the workers in the several branches of the business—is closely allied with the success of our industry, will, I am sure, be generally conceded by you all. That a young man taking the initiatory steps towards education which this Association now holds out to him may be led thereby to continue on lines broader and deeper than we can offer, until he becomes an educated engineer, is what many think possible, I think probable, and we join together in heartily wishing for. A little learning may be dangerous, but who will say that one, who having taken his first draught at the fountain of self-education, may not drink long and copiously. In truth, I feel the Association is to be congratulated on the work so far done by the Committee, and I would take advantage of this opportunity to call the attention of the hundreds in the various divisions of our industry who would be benefitted by what the Association has here to offer. These are keen days. The crowd is ever pushing, hurrying onward, impelled by that inscrutable, indefinable force we call ambition; we must push along with the mass, trying for a position in the front, or our place in life will be but a cipher to give value to some one else. Surely there is no more potent aid and help to hold one's place in this busy world than education.

Another matter given to this same committee is included in the word "Research." If it has not yet moved in this regard, it is because the work already in hand has absorbed the time of the members of the committee. I am sure you will all agree with me that our daily contact with the apparent humdrum details of our business impresses upon us day by day and hour by hour the importance of research into the chemical and physical aspects of our business. Wander into the retort house in a moodish frame of mind and watch the rough stokers throwing the black coal into the highly heated retorts; remember the chemical constitution of that coal, and tell me why are the final products as they are? Is there not field for research here! Consider the various combinations of hydrogen and carbon in the resulting products, figure their values and how the same would be enhanced if we could form other combinations as we would; and, tell me, is there a field for research? Let your thoughts run by for a moment on that one substance—naphthaline; remember how it would add to the value of the flame if we could carry it to the burner tip; and, not forgetting your trials when it solidifies in spite of all your theories, again I would put to you the question as before. And if I would yet once more repeat the query, it would be when you have in mind a few of those purifying house perplexities, which have been our common share. Thoughts like these, which open up a vista of the possibilities of education and research, lead me to the thought that he who would best serve our Association, should abstain from offering suggestions which would carry us farther afield in still new directions, until the work in hand has been carried along to such a stage that its success is assured. One thing well and thoroughly done is much to be preferred to many things but feebly attempted. Two changes and, two only, would I suggest; the first is that the Committee on Education and Research be divided, and that the Education Committee be left free to chose its own chairman, rather than have the position occupied by the Junior Past President.

Our experience this year, when we found that if we were to hold our meeting as to time and place in accordance with the Constitution, we would be totally unable to secure hotel accommodations, points to the wisdom of so changing our Constitution that the Council in such an emergency may have the power to act. I suggest the Council be instructed to bring in such an amendment. I also think it would be well to instruct the Council to obtain from all the members, by mail, an expression of opinion as to the desirability of so changing the date of our annual meeting that it would fall between the 15th and 25th of September.

I would not, however, I am sure I could not, pass from the consideration of Association matters without congratulating you upon the continued and continuing success of our Association, to say to you how rejoiced I am to see it growing more and more National in work and membership, as it always has been in name.

Before I close I would say one word to those who in the years to come are to guide the Association. Am I justified in doing so? I I know not; but this is my excuse—my long service on the roll of officers—thanks to your courtesy. My one word is this, that we lose not sight of the cosmopolitan character of our membership, comprising as it does, presidents, vice-presidents, engineers, secretaries, superintendents and treasurers of gas companies, and those connected with cognate industries, for it seems to me if we so shape the affairs of the Association as to make our meetings acceptable to only one class of that membership we will, in my opinion, lose ground. If at our meetings we consider solely executive matters, of interest only to the presidents, or office affairs primarily for the benefit of the secretaries, surely the scope of our usefulness would be limited. And so I think if we try to make of the Association a purely Engineering Society, if we try to convert the Association into an Institute of Gas Engineers, we will lose the membership and support of many of our friends, who in times gone by have been to us a source of strength.

Finally, gentlemen, the meeting is in your hands, not mine. Yours to do with as you will. I am sure of your decision. I am confident you are anxious this our first convention on the western side of the Mississippi shall be a success. There are two ways the members—rather let me say each individual member—may contribute to the successful

outcome of this convention. By attending promptly at the appointed times for the meetings, and by participating in the discussion of the papers. I am sure you will agree with me that those of our members who have taken the trouble to prepare papers for this meeting are entitled to our thanks, and I would remind you we can best show our appreciation of their labors by coming together punctually at the hours stated in the programme, that they may not be called upon to address empty chairs, by according them your silent attention during the reading of their essays, and by participating in the resulting discussions. Surely this is theirs by right of courtesy, and I know full well they will receive in this regard their just due, if each member will fill his individual responsibility to contribute to the success of the convention.

On motion of Mr. Littlehales the address was referred, for consideration and report, to a committee of three—Messrs. T. Littlehales, J. Somerville and A. S. Miller. The Association then adjourned, to reconvene at 2 P.M.

(To be Continued.)

[Prepared for the JOURNAL.]

The Bunsen Flame.

By DR. W. H. BIRCHMORE.

There are few pieces of furnishing more apt to meet the eyes in chemical laboratories than a Bunsen burner, there are few modes of motion more familiar than its flame, its influence on the economy of daily life is enormous, and yet so scanty is the literature concerning it, and so small is the interest taken in its economy, that hardly anything more is known about it now than was the case when it became a part of the armory of science, two-thirds and more of a century ago. Considered in all the forms to which it has grown since its invention, it may be said to have done more to develop chemistry than any other one tool, except the balance; and now that the relations of its physics and chemistry are being gradually learned, it is quite likely that its influence on science in the next few years will increase rather than diminish, and in certain directions will be simply incalculable.

What a Bunsen Burner Is.—In the vocabulary of everyday life the name is applied without much discrimination to a very large group of machines for burning some inflammable gas or vapor mixed with air. The most familiar form of this machine is a base of iron, supporting a boss of the same metal, into which two holes are drilled, one parallel to the plane of the table, one perpendicular to it, which intersect. Into the hole parallel to the table is screwed a tube which forms the gas connection, and into the other a nipple, through which the gas makes its exit. Around the outside of this nipple is worked a screw. This engages in a thread at one end of a tube, usually 12 diameters long. Near the threaded end of this tube are cut two holes by which air is introduced by aspiration, to mix with the gas from the nipple in the tube, which thus functionates as a mixing chamber, and this mixture forms, when ignited at the open end, the flame we commonly speak of as the Bunsen flame. It is customary to put a movable collar around the lower end of the tube, by turning which the space through which the air enters may be modified; the amount of air entering the tube is thus controlled or cut off altogether.

This simple but efficient structure is the Bunsen burner, an implement intended simply to obtain a very high degree of heat by a perfect combustion of the fuel, but which promises in its recent developments to do far more.

Diverging from this simple typical instrument are two widely parted forms, which may be called the low pressure and high pressure patterns; in the one the mixture of gases takes place at a pressure as little as possible above that of the atmosphere, and the flame tension is simply that due to the temperature of the burning gases. The blast Bunsen is a rude, uncouth instrument, useful for heating things, and having no connection in theory or practice with the blowpipe, with which it is often compared; it will heat things, and so will any other blast. With this form of the development, the blast pattern Bunsen, we have nothing to do.

The low pressure Bunsen burner has not escaped the disposition to change which belongs to all human inventions, and some of the changes have been towards specialization of forms to uses, and are improvements; more are not, and pass away, as might be expected, with the march of time.

Among the improved forms are two: One, the adjustable Bunsen burner, in which the amount of air is supposed to be accurately adjusted to the gas supplied, or the size of the gas orifice to the varying quality of the gas; the other, the Muenche pattern, which has reached its highest development at the hands of the Welsbach interest. For purposes of experiment I have found this form of burner simply ideal, and have made with it studies numerous and satisfactory, making certain small changes to adapt it to my special needs.

These changes may be described from my standpoint as simply conveniences in adjustment, and so dismissed without further mention here.

The conditions of the mixture of gas and air in a Bunsen burner require more attention than they usually receive, but are very simple in statement; they are these. The amount of gas entering the tube must be sufficient to prevent the formation of an explosive mixture, as otherwise the tendency will be to light back; at the same time another danger must be avoided, for if the entrance of air is too rapid the flame is cooled by its presence and also rendered destructive. In a word, the flame of a perfectly adjusted Bunsen is so nearly neutral that the least reduction in the amount of air entering the tube will cause it to smoke—*i. e.*, to become luminous.

This, briefly, is the condition of working in the ordinary burner. In the more perfect machine, the Welsbach, the top is covered by a gauze hood, which insures a perfect mixture and diffusion of the gases, and makes possible the use of a mixture so accurately balanced that lighting back would be the inevitable consequence with an open burner, and at the same time reduces the tension to the lowest possible.

It must be understood that the flames obtained from mixtures of inflammable gases of any sort with air are controlled by two distinctly independent variables, and a third, which is, or ought to be, a joint function of the other two. The first independent variable is the composition of the fuel. The second is the form of burner employed, while the third, which, as before said, is a function of the other two, is the air supply. This dependent variable plays an important part in the chemistry and physics of the flame which will be discussed in detail later.

The flames on which this paper are founded are those obtained from a number of different burners belonging to three distinct patterns: The ordinary Bunsen, three ordinary, or but slightly modified, Welsbach burners, and one much modified, or, rather, quite rebuilt, which I see fit to call the ideal Bunsen, because in it the amount of gas and air could be accurately controlled and the amount of each determined.

Deductions drawn from experiments with this burner are always mentioned as such, the experiments being given. Unless so mentioned the appearances and results belong to the ordinary burner, and the Welsbach burners, which were modified only in such a way as to determine accurately the amount of air and gas delivered, while in the ideal burner both gas and air were delivered under pressure. In the Welsbach the air enters by the draught of the chimney, in the ideal it enters by a pressure, small in amount but positive. Making use of these burners, nearly every available gas from hydrogen to ethine has been studied to some degree, but the study on which this paper was founded was made into the behavior of the illuminating gas of this city, which is an enriched gas.

With the chemical composition of this gas I have nothing to do, except in a most general way; it is enough to say that it contains both true gases and hydrocarbon vapors of various molecular weights and compositions. These act in manners so different that the physical behavior of the flames presents characteristic changes, when submitted to examination with instruments of precision and delicate adjustment, yet whose routine is so nearly constant that the observations, extending over many nights, make a whole which may, without undue violence, be called symmetrical and be described as such. This symmetry I cannot predicate, when examined by my burner supplying measured amounts of gas and air—the one above mentioned, as constructed for examining the flames of gases under conditions of control; but it comes out distinctly when the ordinary Welsbach burners are used; and for the sake of this symmetry of behavior the flame from such a burner is made the basis of this paper, rather than that from the perfected instrument. Only enough observations with the perfected instrument are introduced to make clear points otherwise inexplicable.

These studies were systematically made, the entire programme of important points being gone over at each sitting.

The Form and Color of the Flames.—In the ordinary Bunsen burner the flame form is entirely dependent on the pressure of the gas, the air entering by aspiration through orifices below the level of the chamber, the nipple end reaching above the bottom of the windows.

This flame rises from the top of the tube and widens slightly, terminating in a more or less fine point, according to the intensity of the gas stream. It is composed of three distinct portions, which when

viewed slightly at an angle present differences in refractive power. For convenience I shall use the names, inner cone, body of the flame and envelope to express these parts. The inner cone is of an intense green color, and when the gas is turned on full the size of the cone is four diameters high, but when the flame is burning at its best and most efficient condition, 2½ diameters. The middle portion of the flame is of a bluish hue, which can be plainly seen when rifts take place in the envelope, which occur quite frequently. The envelope is very thin, and is red. This redness is peculiar in that it bears towards carmine, while when the orange flashes of sodium occur in it the impression is given of an eosin hue. So thin and irregular is this envelope that one can quickly see by examination that it plays like an iridescence upon the body of the flame, and that the color of the flame is caused by the shining through the envelope of the light of the cone within, and the mixing of the two colors in the beam which reaches the eye. This mixing produces the peculiar violet color which is characteristic of the flame, for the Bunsen flame of this gas is neither blue, nor bluish, but it is distinctly violet, when burned as stated.

This flame is very steady, and while it has some disposition to flicker this disposition is not more than can be accounted for by the motion of the surrounding air. If, now, the internal air supply is cut off, so that the flame is rendered luminous, the flame instantly begins to flicker and swing, and the motion is not controllable by a chimney—is only regulated so that it takes place with a distinct rythm, while small and irregular internal vortices show themselves as distinctly as in the unprotected flame.

The behavior of the Welsbach burners is somewhat different. When the gas enters with force sufficient to cause a great influx of air, the flame without the chimney presents certain distinctions from the common Bunsen.

From the greater size of the orifice of exit the tension of the mixture is less, and this flame is more distinctly cone shaped. This flame presents the same green cone, the same bluish body and red envelope, the same violet color, but the rifts in the envelope distinctly show that the envelope is less important in imparting color to the flame. The entire flame has a violet tinge, which, while more intense on the surface, is distinct throughout.

This flame is modified in many of the burners, even when burning without a chimney, by a distinct blue ring, about one-half a diameter high, about the base of the flame. There is also a certain unsteadiness of the flame in the near vicinity of the gauze, the flame at this level seeming to be filled with small explosions at times, as if the mixture were not quite even. These irregularities disappear when the chimney is put on, and flame gains in steadiness, while the upper part, because perhaps of higher temperature, without presenting any of the appearance of an ordinary luminous flame, appears to whiten. The whitening, however, is irregular, seems to be on the outside of the flame, and to suggest that it is external to the red envelope which determines the violet hue of the flame. This "white envelope" is also thin, and streams over the flame, as does the red envelope; suggesting in fact a continually moving something which bears a definite relation to the flame beneath. The definiteness of this envelope seems to increase with the length of the chimney.

If a Welsbach burner is used, in which the diaphragm is left intact in the way in which it was placed by the makers, instead of using a nipple to cause the entry of the gas, and the chimney be not used, the behavior of the flame will depend upon the individual burner; but these are two facts not for an instant to be desired. The flame of the burner with the nipple, whether ordinary Bunsen or Welsbach, is always nearly neutral and has zones of varying heat, the upper third being distinctly less hot than the middle one.

In the ordinary Welsbach—that is the Welsbach with the diaphragm—this is hardly, if ever, the case. The flame is always a reducing one, often most intensely so. The heat is more evenly diffused in the interior, while the outside surface is far hotter than the interior. The top of the flame, say its upper one-fourth, seems to be the hottest part, and if the chimney is long enough, about one half longer than the one they usually furnish, so intense a heat may be reached as to fuse a small platinum wire; at the same time there are evidences of an incomplete combustion.

It is also to be noted that in this case the white envelope, which was mentioned in the case of the "nipple" Welsbach, is wanting, and the red envelope is much thicker and more consistent; indeed it seems almost to contain the flame as a case—the flickering, iridescent appearance is quite wanting, as if the envelope no longer flowed, if I may use this expression, upon the surface of the flame.

If to this series of observations the following be added, some curious speculations become possible. These observations were made on a burner in which the supply of air and gas was perfectly under control, the fittings being practically gas tight, still it was not further modified.

The proceeding in this experiment march was as follows: The amount of gas which the burner could handle with full air draft was determined; that is to say, the maximum amount the burner could be made to consume. This amount was then considerably exceeded and the air cut off.

I wish to record two series of experiments, made up by combining a great number of separate sets of observations in each of them. These two series differ in only one particular—the height of the chimney. In one case the chimney was five inches in height, measured above the top of the gauze; in the other case, eleven inches.

First Series.—The gas supply having been regulated and the air cut off, the flame formed a waving, unsteady torch, swinging in the chimney with a distinctly spiral motion, luminous and not more inclined to smoke than in an open burner of any sort. This flame was more luminous at the bottom fifth than at any other portion, because the air supply was more plenty and the temperature, therefore, higher; but the part above the top of the chimney flamed out again in glittering heat as if the temperature were largely increased by the freer access of air. The bottom of this flame was surrounded by a pale blue envelope about an inch in height. On opening the slide slowly to admit the air, a blue flame gradually extended from the top of the gauze hood upward to the height of three inches, and there was not one tinge of green to it. Above this blue column the luminous flame recommenced, and the top of the whole flame column was measurably at the same point to which it came before the air was admitted. It required careful management of the gas, but it was possible to maintain these relations seemingly indefinitely. By cautiously managing the gas and air the green cone could be made to appear as a ring inside the blue, at the surface of the gauze, and gradually extended until the lower third of the flame seemed to consist of two symmetrical tubes; one blue, the outer one; one green, within. The innermost part of the tube seemed quite empty of flame. Gradually increasing the amount of air in proportion to the amount of gas, the green tube became more pronounced in color, seemingly thicker, presented more of the appearance of the "green cone," but was not conical. Gradually decreasing the amount of the gas, the cone shape of the flame appeared at first very slowly, then more rapidly. The blue envelope seemed to climb up the outside of the flame, but there was no trace of the red envelope or the violet color visible. This continued with increased volume of air in proportion, the gas being diminished, until the structure presented by the flame was as follows. The green cone was distinctly formed, but was truncated, or, rather, it seemed to terminate in a ring or vertex crowned by a short, but sharply defined, cone of luminous flame, which had the hypo-chromatic white color obtained by viewing an ordinary gas flame through a blue, or a Welsbach mantle through a yellow film.

Surrounding this curious structure of the interior of the flame comes the blue flame body, which seems to form the entire balance of the flame, whose color, unlike that of the flame of more nearly neutral reaction, for this is a distinctly reducing one, is blue and not violet.

Decreasing the gas supply a little more, the red, streaming envelope appears; at first, near the bottom, it gradually extends over the flame until the point of neutrality is reached and the incandescent top to the inner green cone disappears—just disappears and reappears in a vague way. If the gas supply is decreased just a little more, all the phenomena of the flame previously described are visible, except the whitened upper part. The streaming red envelope covers the whole outside the flame, the blue shines through, the flame is purple, while the green cone fills the center and the bottom boils. Decrease the gas the least measure more, and the incandescent top to the green cone reappears, the flame becomes irregular, and fails to cover the whole of the gauze, holes appearing to form through which the air rushes under the impulse of pressure of the air induced by the currents in the heated chimney.

The longer chimney seems both to augment the intensity of the phenomena produced by the shorter one, and also to cause certain phenomena distinctly its own production. As stated, this chimney is rather more than twice as long as the short one, but its diameter is the same; consequently it has a draft not obeying the same law.

The increased length of chimney, by increasing and steadying the draft through the air spaces of the burner, still more effectually than the shorter one brings into play the use of the gauze hood in thoroughly mixing the air and gas, and makes it possible, within a given space, to consume a larger portion of fuel than is possible with the shorter chimney, in this way exactly reproducing the conditions which obtain

when the rushing of the gas current through the nipple increases the air supply by aspiration. If, however, the gas supply is increased beyond the capacity of the air supply, the conditions of the flame in the shorter chimney are reproduced, and the incandescent point to the green cone appears.

Otherwise it may be said the various phenomena observed when the shorter chimney is used are all exaggerated in amount.

The chief new phenomena are the small explosions in the flame, which are now not only visible but audible. These explosions seem to occur, as before, only when the flame is rendered perfectly neutral, and are really violent, in some cases causing the chimney to be shaken, and seem to be accompanied, as in the case of the flame without a chimney, by ineffectual attempts of the flame to pass the barrier raised by the gauze hoods. After a few minutes these explosions seem to become equally spaced in time, as if the "musical note" of the chimney in some way controlled them. With a very long chimney (say 2 feet) this is by no means impossible; and with a chimney of this length they would be very violent. A built up chimney of 18 inches made the violence sufficient to make the parts unsteady.

There is one phenomenon, however, which appears with the increased length of the chimney, that is quite unlike any which occurs without the chimney, or with any short one. This phenomenon, for lack of better identification, I propose to call "the phenomenon of the luminous particles."

This phenomenon consists in the appearance within the green cone of small, round (apparently) white-hot particles, which rise axially through the flame, disappearing in the upper fourth or fifth of the inner violet blue portion, but which sometimes reach the red envelope and pass, or seem to pass, through it, and in reaching the outer surface of the flame ignite there, burning seemingly in contact with the air which surrounds it with a color which, by contrast with the hue of the flame, seems to be a brilliant, orange yellow; in fact, the color of cadmium yellow exactly. This phenomenon is not new to me among gas flames, but is very seldom seen, and I have never seen it before in illuminating gas furnished through long ranges of pipes. I have seen it previously only in "gas" from "gas machines," and usually when newly charged. The significance of this phenomenon I do not attempt to discuss, as any discussion can be only tentative. From certain evidence, however, I believe these particles to be minute drops of some very complex hydrocarbon of high breaking temperature. There may be a possibility of other explanations, but the subject is one of difficulty.

The Spectra of these Flames.—Much might and much must be written on the spectra of these flames before their physics can be properly understood, and much labor must be expended in study and investigation; and it does seem strange that so little has been done. Men have used the heat of the Bunsen burner for nearly two score years as a tool for the study of the spectra of the elements, and yet for some reason the details of the spectra of the flames seem to present no interest, or at least not influence enough to provoke discussion. It is not my intention at this time to add much to a paper already long, but a few words on these beautiful and intricate subjects of study may not be out of place.

The spectra of these flames present an extraordinary tangle of bright lines and dark ones, of continuous spectra, and continuous spectra crossed by bright lines, but in a general way it may be said that it presents a hunting ground well worth exploring, and one where the best of instruments are none too good.

There is one thing, however, which is well deserving of mention—the green cone spectrum. This is distinctly a spectrum of carbon, and, wonderful to tell, it agrees not with the electrically produced spectrum of any form of carbon from hydrocarbon gases, but is in exact agreement, line for line and space for space, with that obtained by the electrical spark from olive oil. The violet lines of this spectrum are also important to the last degree, bringing out relations far too complicated for discussion here, but which bear directly on the relations which exist between modifications of certain spectra in exhauster tubes, and those of the inflammable gases and those which sustain combustion.

Nor is there space sufficient at the moment to discuss the connections of cause and effect in regard to the color of these flames and that of the constituents.

It is enough to say that distinct and assignable spectra exist for the green cone, the blue flame body and the violet hue which give place to it under certain conditions, while the remarkable play of colors on the surface of the flame gives to the spectroscope information which links with some of the highest physico-chemical studies of the day.

To repeat in other words the remark that prefaces this paper, the influence which the renewed interest in these flames promises to exert will prove as beneficial to science as was the invention of the burner which has made the study possible.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Board of Street and Water Commissioners, of Jersey City, N. J., will open proposals to-morrow for the lighting of the streets, the bids to be for one year, three years and five years, respectively. The minimum number of arc electric lamps is put at 900; of Welsbach lamps, at 100; of ordinary open flame gas lamps, 300; of oil lamps, 700. In respect of the maximum number of lamps of the named classes that may be required the stipulation is: The maximum number will be limited by the appropriations in the tax levies during the term of a possible contract, with due regard to other contract requirements.

AT the annual meeting of the Troy (N.Y.) Gas Company the following Trustees were chosen: A. Bleecker Banks, A. E. Bonesteel, Anthony N. Brady, Thomas Breslin, Fred. E. Draper, James Fleming, S. O. Gleason, George P. Ide, William Kemp, F. J. Molloy, Edward Murphy, Jr., R. C. Pruyn and William A. Thompson.

MR. WILLIAM ANDERSON, Superintendent of the East Boston (Mass.) Gas Company, reports that Messrs. Davis & Farnum have just commenced work on the new holder, and that the understanding is that the vessel will be completed December 1st. Mr. Anderson also announces that he has finished the placing of 3,000 feet of 8 inch pipe—it was put down in place of a 3-inch line—and is now at work on a like length of 4-inch pipe through districts heretofore unsupplied with gas.

WE regret to report the death of Mr. Edmund D. Halsey, a prominent Director of the Morristown (N.J.) Gas Light Company. Deceased was born in Rockaway, N. J., September 11, 1840, and graduated from Princeton College with the class of 1860. He was admitted to the New Jersey bar in 1865, and located in Morristown, practicing his profession there up to his last illness. He was very prominent in the political and social history of Morris county, and at the time of his death was Secretary and Treasurer of the Washington Association and a valued member of the New Jersey Historical Society.

THE contract complete for the new power house and car barn of the Union Traction Company, of Rutherford, N. J., has been awarded to the Berlin Iron Bridge Company, of East Berlin, Conn. The buildings are to be of brick, with steel frame work, and the plant when completed will be up to date in all respects. The car barn is to have a dimension of 97 feet by 100 feet, and the offices, storerooms and repair shop will adjoin it. The engine room is to be 50 feet by 65 feet, and the boiler room will be 40 feet by 65 feet. The roofs are supported on steel trusses, and the covering throughout is to be of corrugated iron. The roof of the engine house is to be lined with the Berlin Company's patent anti-condensation fireproof lining.

THE Town Council of Warren, R. I., has given the Bristol County Gas and Electric Company leave to withdraw in the instance of its petition for the right to supply gas and electricity in Warren for a period of 25 years. The main features of this petition will be found in our item columns for Oct. 19th last.

THE projectors of the Citizens Fuel Gas Company, for Yonkers, N.Y., have not abandoned all hope of obtaining a franchise, their Attorney, Mr. Samuel H. Wandell, having recently submitted to the Common Council a franchise amended to conform to the suggestions made at a prior meeting of the Council when the original petition was under consideration.

THE Coney Island (N. Y.) Gas and Fuel Company has about completed the work of laying mains through the highways of the district of Sheepshead Bay. If we mistake not, the right to put down pipes in Sheepshead Bay was granted to the Company some time in 1893, and the wonder is that the work was not performed long ago, for the "Bay" contains a goodly number of substantial residents.

THE people of the town of Jeanette, Pa., are loud in their protestations against the determination of the Jeanette Natural Gas Company to increase its selling rate to 25 cents per 1,000 cubic feet.

THE new retort house for the 25th Ward plant of the Philadelphia gas works is to have a dimension of 318 ft. 10 ins. by 60 feet. The contractor is Mr. George W. Stewart.

THE new holder for the Atlanta (Ga.) Company will be completed by December. The capacity is 1,250,000 cubic feet, and the contractors are Messrs. R. D. Wood & Co.

THE following is the text of an announcement made some days ago by the proprietors of the Fall River (Mass.) Gas Works Company: "For gas consumed after November 1st, 1896, net rate will be as follows: 5,000 feet or less per month, $1.25 per 1,000 feet; 10,000 feet or less per month, but over 5,000 feet, $1.20 per 1,000 feet; over 10,000 feet per month, $1.15 per 1,000 feet. Bills will be rendered at $1.40 per 1,000 feet, from which discounts will be allowed, so as to make the net rates as above on all bills paid on or before the 15th of the month. This reduction will take effect on bills rendered on and after December 1st."

MR. W. W. SCARBOROUGH, formerly President of the Cincinnati Gas Light and Coke Company, died at his home in Cincinnati about a fortnight ago.

THE Boston *Herald*, of October 25th, said: "The Board of Gas and Electric Light Commissioners have authorized the Brookline Gas Company to increase its bonded debt by $425,000. The Company asked for authority to issue $1,000,000 additional bonds. It already has $1,000,000 outstanding. The adjournment of the Company's annual meeting, without election, to November 2d, carries it one day past the expiration of the Whitney syndicate option on control of the Brookline stock. Whether that option can be availed of is reported to depend upon the decision of the Delaware Court in the Bay State receivership case. The $1,000,000 which the Bay State people said that they stood to make by negotiations interrupted by the receivership suit is surmised to refer to the $1,000,000 already put up in the Brookline deal, but which might be forfeited if the deal fell through."

"OBSERVER" forwards the following: "The Chelsea (Mass.) Gas Light Company, the business office of which has been for many years in the second story of the Stebbins' block in Chelsea Square, has taken up its new quarters, just fitted up for its use on the ground floor, No. 187 Winisimmet street, in the square nearly opposite its former quarters. The new office is in the building of the Academy of Music, and is convenient of access from the street. The new fittings of the place are most modern, convenient and handsome. The right side of the office is parted by a handsome gilt iron fence for the transaction of business by the officials, while in front of the rail there are accommodations for the public. A brilliant feature at night is the illumination afforded by 100 incandescent lamps which light the spacious apartment. The floor is handsomely laid in mosaic. The new office is not only in a pleasant location, but is highly convenient for the public and the Company. Col. Moses, the urbane Treasurer, and the other officials must be more than pleased over the new condition of of affairs."

THE Welsbach Light Company has instituted suit in the United States Circuit Court, District of Massachusetts, against D. L. Clark, of 515 Essex street, Lynn, Mass., for the alleged sale and use of incandescent burners which complainant asserts constitute infringements of its patents. A writ of injunction is asked for to restrain the defendant and his attorneys, servants and employees from any further manufacture, sale or use in any manner or way whatever, of the said improvement and inventions, in the manufacture of incandescent devices for gas burners or devices containing the improvement and invention, or any part thereof, and that the improvements now in possession or use of the defendant may be destroyed or delivered up to the complainant Company. Complainant also asks that the damages be assessed at $10,000.

THE proposed name of the corporation that is to succeed to the joint properties of the San Francisco Gas Light Company and the local Edison concern is the San Francisco Gas and Electric Company.

THE following letter, forwarded by Mr. T. Littlehales, General Manager of the Syracuse (N. Y.) Gas Company, to the editor of the Syracuse *Post*, explains itself: "The story that the Syracuse Gas Company is employing Canadian labor to the exclusion of American citizens has no foundation in fact. As far as I know, there is not one Canadian employed in the works. In the office there is not a Canadian employed. On the streets all the men are employed by the foremen. The foremen have long been residents of Syracuse and are American citizens. I am not aware that there is one man connected with the Syracuse Gas Company who is not an American citizen. Three of the men employed by the Company had worked in Canada before we engaged them. They made personal application on the ground, and being especially adapted for the work required of them, they were engaged."

THE permanent residents of Ocean Grove, N. J., are very outspoken in their condemnation of the stand taken by the Association that controls all the "temporal and spiritual" matters of the famous camp meeting ground, in the instance of the refusal of the Association to permit the Consolidated Gas Company, of New Jersey, to lay pipes under and through the public ways of the "Grove." The real fact underlying this refusal is that the Association owns the electric light plant that illuminates the place, and it does not care to have its monopoly disturbed. A local paper, in commenting on the case as it stands, says: "Not more than one-twentieth of the property owners use the electric light on account of the heavy expense involved, so it is evident that those of the other nineteen-twentieths who desire to use gas and cannot secure it are being unjustly treated, simply in order to advance the interests of the electric light department. If such a condition of things existed in any place other than Ocean Grove, it would be regarded in the light of a monopoly of an extreme character. While the sentiment of the people is strongly in favor of the introduction of gas, some action must still be taken to place these opinions in form that they may be laid before the Association at its annual meeting, to see if that body will not effect some arrangement whereby the residents of Ocean Grove may be accommodated in this particular. If the proper spirit is manifested in the matter by those having the power to determine the affair no great difficulty need be experienced in bringing the question to a satisfactory solution, as the Gas Company stands ready to lay mains and supply the people with gas; or if the Association will lay the mains the Company will supply the gas at wholesale rates, allowing the Association to make all the profit that may result from retailing it to the consumer."

THE Board of Trustees, of Sacramento, Cal., will, on the 23d inst., meet for the purpose of passing upon the application of the projectors of the Pacific Gas Light and Fuel Company for the right to manufacture and distribute illuminating and fuel gas in Sacramento for a period of 25 years.

MESSRS. B. KREISCHER & SONS desire us to announce that for the convenience of their customers and the trade generally, they have removed their main offices and sample department to No. 119 East 23d street, New York. All business communications should be forwarded to the named address.

THE following is the amended selling schedule of the Santa Ana (Cal.) Gas and Electric Company: Gas for fuel purposes, $2 per 1,000; for lighting use, 1,000 to 3,000 feet per month, $3 per 1,000; 3,000 to 6,000 feet per month, $2.50 per 1,000; 6,000 to 10,000 feet per month, $2.25 per 1,000; 10,000 to 20,000 feet per month, $2 per 1,000; all over 20,000 feet per month, $1.75 per 1,000; coke, $14 per ton; tar, $3.50 per barrel.

A LEADING feature of the pageant in connection with the memorial exercises in honor of the late Hon. Manuel Romero Rubio, of the City of Mexico, was the exterior and interior illumination of the National Theater, in which structure the services were held on the night of October 14. The illumination was of a mixed nature, in that gas lights and arc and incandescent electric lamps were employed. A notable piece was that arranged for the facade of the theater. The design was an oblong inclosing an ellipse, in the center of which were the letters "M. R. R.," coronal rays surrounding the ellipse. This design required 246 incandescent electric lamps of 16-candle power each, and was perfected by Mr. W. S. Knight, of the Mexico Gas and Electric Light Company.

THE proprietors of the Salinas City (Cal.) Gas and Water Company have acquired the rights and properties of the Salinas Light (electric) and Water Company, and the whole have been merged into a concern to be known as the Salinas City Light and Water Company, which is capitalized in $200,000. The officers are those who formerly conducted the business of the Salinas City Gas and Water Company.

THE Burlington (Iowa) Railway and Light Company has been incorporated with a capital of $1,250,000. The object of the concern is to acquire and operate steam and street car lines, gas and electric lighting plants, power and steam heating plants, etc.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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MONDAY, NOV. 2, 1896.

The Market for Gas Securities.

An erratic money market, with short loans placed in some instances at as high a rate as 100 per cent. per annum, caused considerable disturbance in the general share market; but on the whole values for gas shares have been sturdily maintained. Consolidation opened today (Friday) at 144 to 147, but before noon one sale was recorded at 149¼, and 149 was bid. Equitable shows no change, while Mutual is very much improved, at 222 to 227. Standard common was inquired for, at a half point advance over the bid rate of a week ago, the preferred remaining at former quotations. New York and East River common is higher, and the preferred is also reported at a sharp advance. Brooklyn Union is somewhat better off than a week ago, but the price at which it is offered (91) appears to us to be ridiculously low. The bonds are steady.

The feature of the week in out of-town shares was the upward movement in Chicago gas, which sold above 71, and then reacted to 66⅞. Yesterday it sold up to 69, on the announcement that the injunction restraining the payment of dividends had been so modified as to permit the Company to disburse to its shareholders the cash that had been accumulated from earnings. It was thought that the management would pay a round dividend at once (the accumulation, it is thought, amounts to sufficient to pay 8 per cent. on the capital), but current indications are, that the first payment will not exceed 2 per cent. The injunction still holds good in respect of the shares standing in the name of the Fidelity Trust Company of Philadelphia, which holdings are supposed to represent about 10 per cent. of the Chicago Company's capital. At noon to-day the stock was 70⅛ bid. We have all along advised the purchase of Chicago gas, and we believe that intrinsically it is worth 80.

Bay State is 8½ to 9½, and many are awaiting anxiously the outcome of the proceedings to make permanent the temporary injunction. There is some demand for shares in the East Newark (N.J.) Gas Light Company. Baltimore Consolidated is steady, at 62½ bid, and Lacledes are easier.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

Nov. 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,480,000	100	144	147½
Central	500,000	50	150	.
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	192	197
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	222	227
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
Northern	150.000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	35	37
Preferred	2,000,000	100	62	67
Bonds 1st 5's	3,500,000	1,000	100	101
" 1st Con. 5's	1,500,000	.	85	88
Richmond Co., S. I.	348.650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	81	81½
Preferred	5,000,000	100	105	108
Bonds, 1st Mortgage, 5's	1,500,000	1,000	107	111
Yonkers	299,650	50	180	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	89	91
" " Bonds (5's)	15 000,000	1,000	105½	106
Bay State	5,000,000	50	8½	9½
" Income Bonds	2,000,000	1,000	27	30
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	70	..
2d " " "	3,000.000	1,000		57
Buffalo Mutual	750,000	100	125	..
" Bonds	200.000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	69¾	70
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	70	80
" Bonds	600,000	1,000	99	101
Cincinnati G. & C. Co.	7,000,000	100	197½	198
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	30
Bonds (6's)	150,000	1,000	.	..
Consolidated, Baltimore	1,000,000	100	62¼	..
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910.000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2.000.000	1,000	..	101
Fort Wayne	2,000,000	..	78	83
" Bonds	2,000,000	..	82	86
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	125	130
" Bonds, 6's	2,650,000	..	102	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	80	85
Bonds	1,000,000	1,000	84	87
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	22	22½
Preferred	2,500,000	100	65	75
Bonds	9,034,400	1,000	91	..
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	52	53¼
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	92½	93¾
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500.000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	59	63
Bonds, 5's	3,556,000	.	88	91
Wilmington, Del.	500,000	50	180	182

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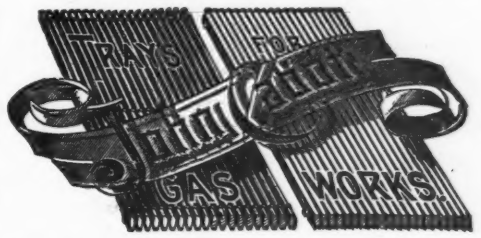

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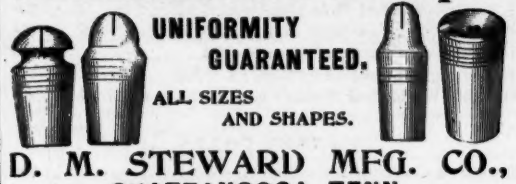

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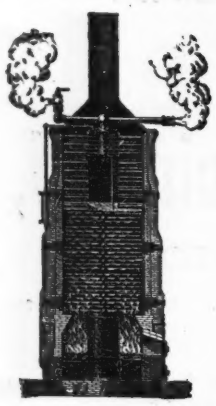

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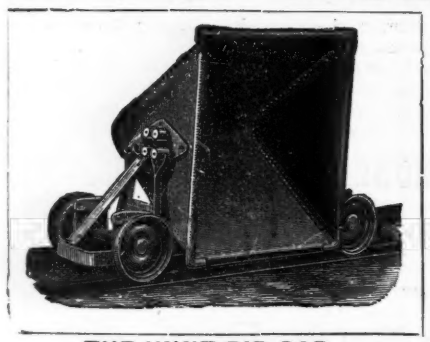

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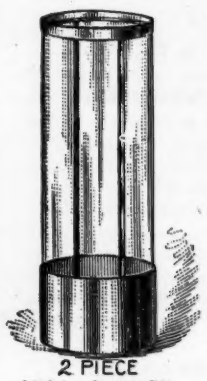

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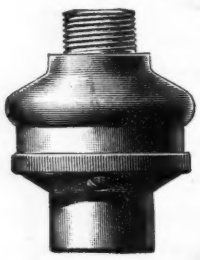

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PROSPECTUS.

THE object of the **Gas Exposition** is to bring together a collection of gas apparatus and appliances of every description, for the two-fold purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years. In submitting the plan of the Exposition to those who may feel an interest in the project, the management would call the attention of manufacturers of supplies of every description, entering into the manufacture of gas, to the great benefits which similar affairs have conferred on the industries of Great Britain, Germany and France, in which countries the exhibitions of gas appliances are held with recurring frequency. The creation of a healthy public sentiment in favor of gas is one of the first aims of large numbers of foreign gas companies.

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In the selection of New York for the inauguration of an enterprise of this character, it is believed that no mistake has been made. In this city the Madison Square Garden is looked upon as one of the great show places of the metropolis; it contains within its walls the requisite space for the proper display of an almost unlimited amount of product, without which an affair of this kind cannot hope for the stamp of public approval—hence the selection of this great building for the inauguration of the gas industries exposition during the two weeks beginning January 25, 1897.

The greater New York contains a resident population of 3,000,000 people. Within a radius of 50 miles of Madison Square Garden live 4,500,000 people; reliable statistics show that an average of fully 100,000 strangers visit New York every day in the year. Thus it will be seen that the gas exposition will draw from a population of fully 6,000,000. In this connection it may be stated that every effort will be put forth that ingenuity can devise to thoroughly advertise the exposition, and create a desire in the minds of the public to come to the show; and once within its portals the dazzling brilliancy there abounding, coupled with the many attractive and instructive exhibits, will cause the visitor to wish to come again.

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On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES.
} IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL.) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

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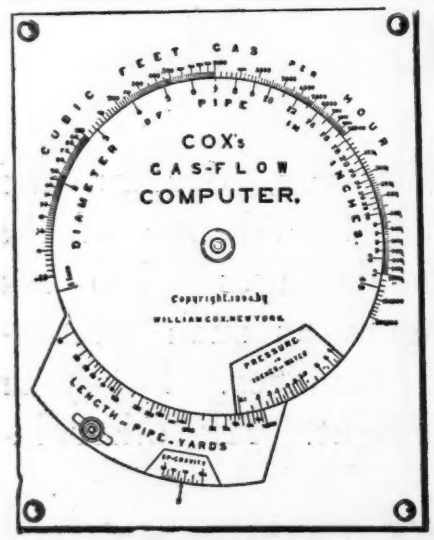

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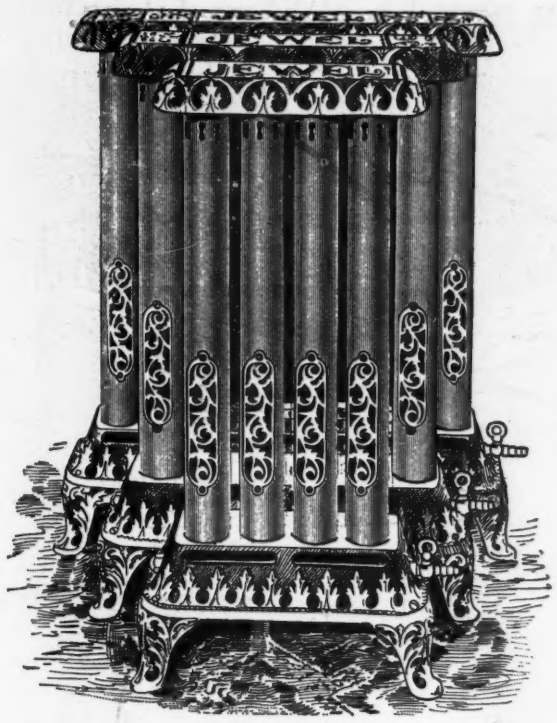

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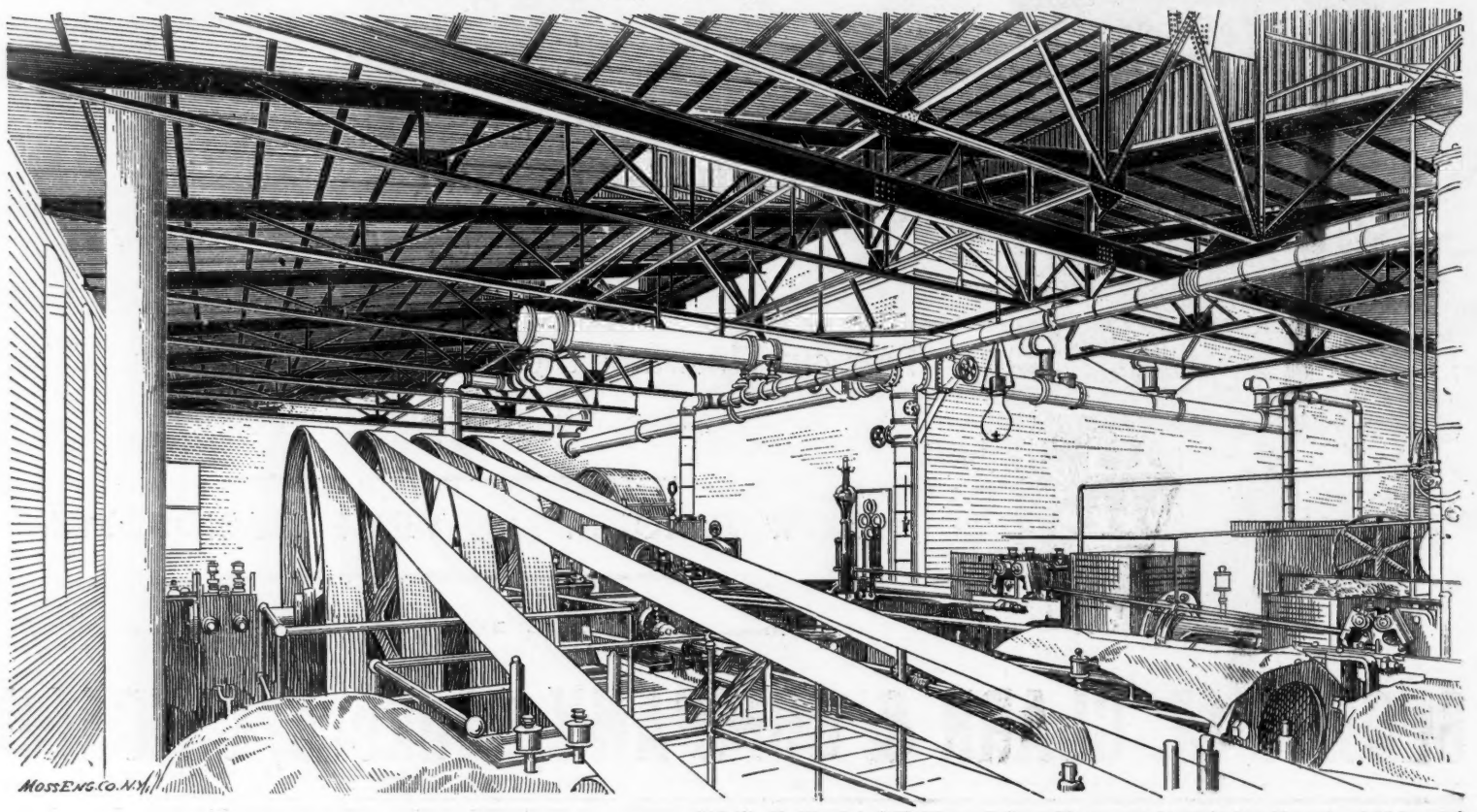

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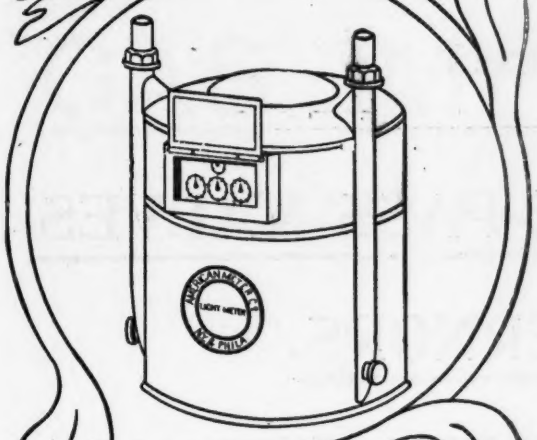
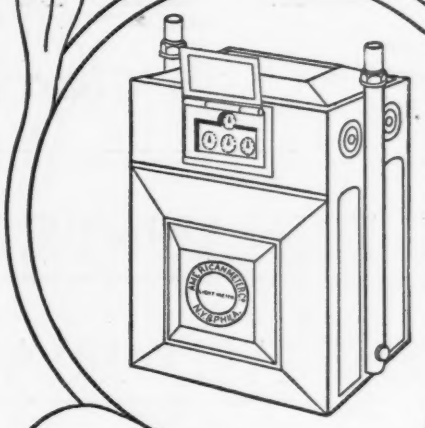
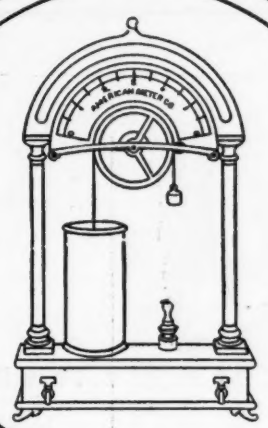
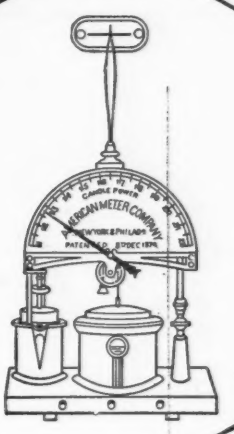




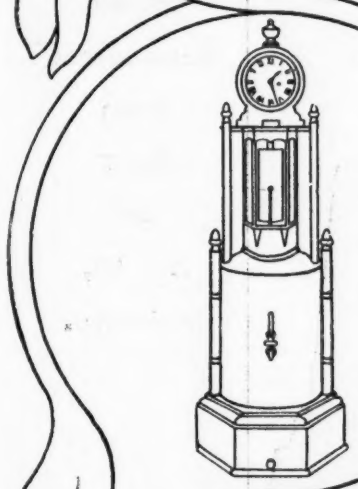


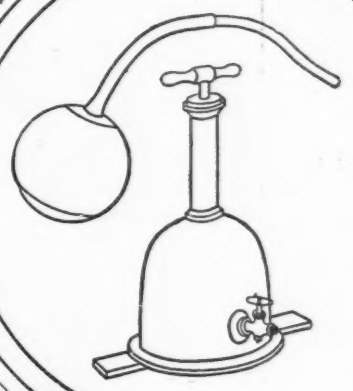


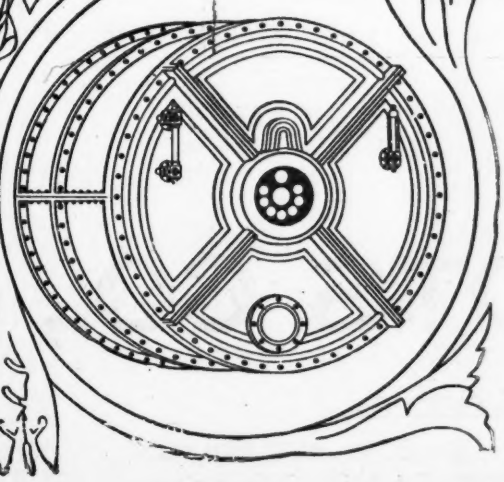
PUBLIC LIGHTING TABLE.

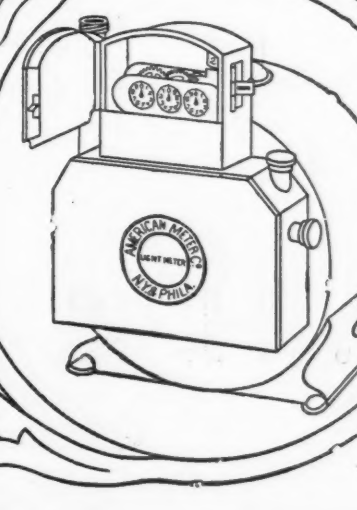
NOVEMBER, 1896.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light. P.M.	Table No. 2. Extinguish. A.M.
Sun.	1	5.20 PM	5.30 AM	4.45	5.35
Mon.	2	5.20	5.30	4.45	5.35
Tue.	3	5.20	5.30	4.45	5.35
Wed.	4	5.20 NM	5.30	4.45	5.35
Thu.	5	5.20	5.30	4.40	5.45
Fri.	6	5.20	5.30	4.40	5.45
Sat.	7	5.20	5.30	4.40	5.45
Sun.	8	5.20	5.40	4.40	5.45
Mon.	9	7.50	5.40	4.40	5.45
Tue.	10	9.00	5.40	4.40	5.45
Wed.	11	10.10 FQ	5.40	4.40	5.45
Thu.	12	11.10	5.40	4.30	6.00
Fri.	13	12.10 AM	5.40	4.30	6.00
Sat.	14	1.10	5.40	4.30	6.00
Sun.	15	2.10	5.50	4.30	6.00
Mon.	16	3.10	5.50	4.30	6.00
Tue.	17	4.10	5.50	4.30	6.00
Wed.	18	No L.	No L	4.30	6.00
Thu.	19	No L. FM	No L.	4.25	6.00
Fri.	20	No L.	No L.	4.25	6.00
Sat.	21	5.10 PM	6.10 PM	4.25	6.00
Sun.	22	5.10	7.10	4.25	6.00
Mon.	23	5.10	8.10	4.25	6.00
Tue.	24	5.10	9.10	4.25	6.00
Wed.	25	5.10	10 20	4.25	6.00
Thu.	26	5.10	11.30	4.20	6.10
Fri.	27	5.10 LQ	12.40 AM	4.20	6.10
Sat.	28	5.10	1.50	4.20	6.10
Sun.	29	5.00	3.00	4.20	6.10
Mon.	30	5.00	4.20	4.20	6.10









TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00

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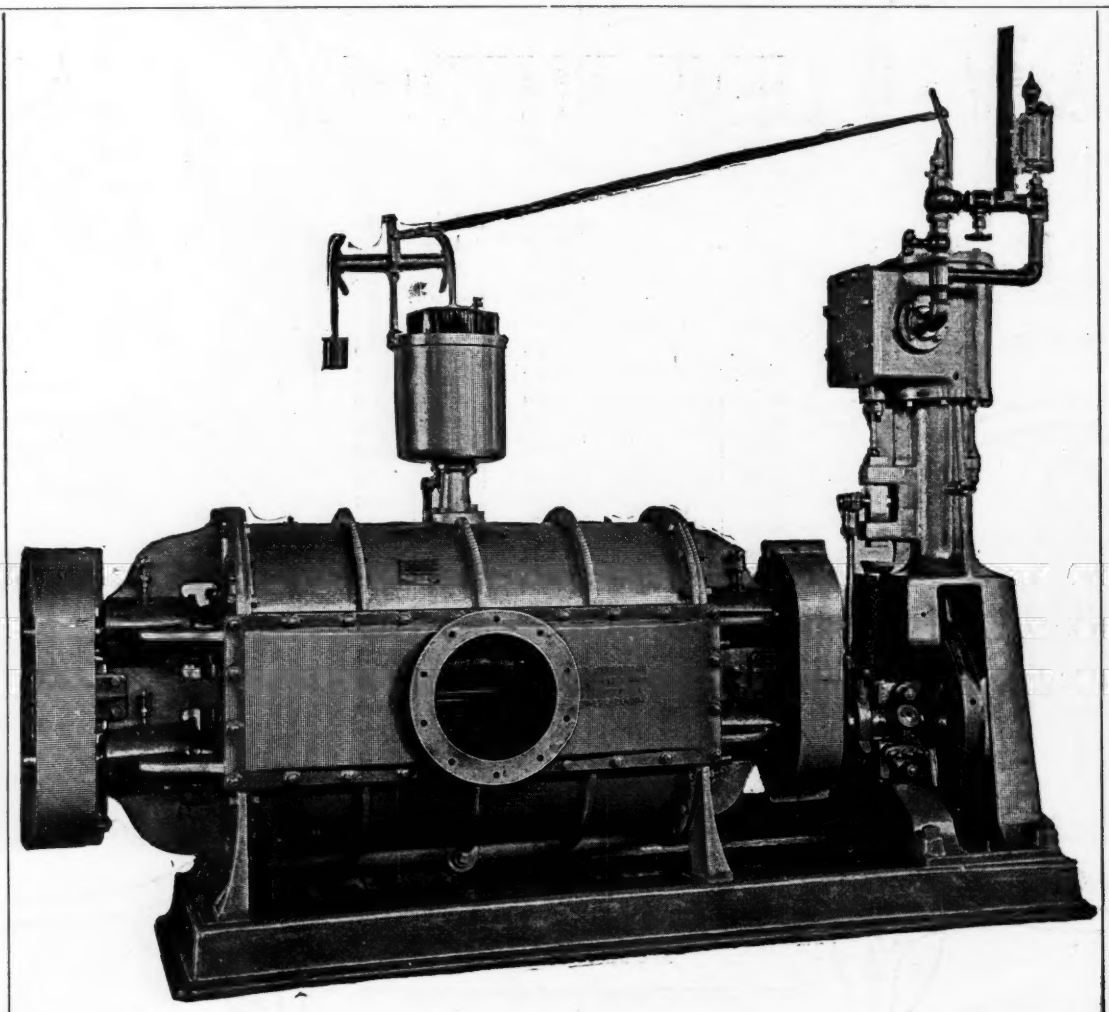

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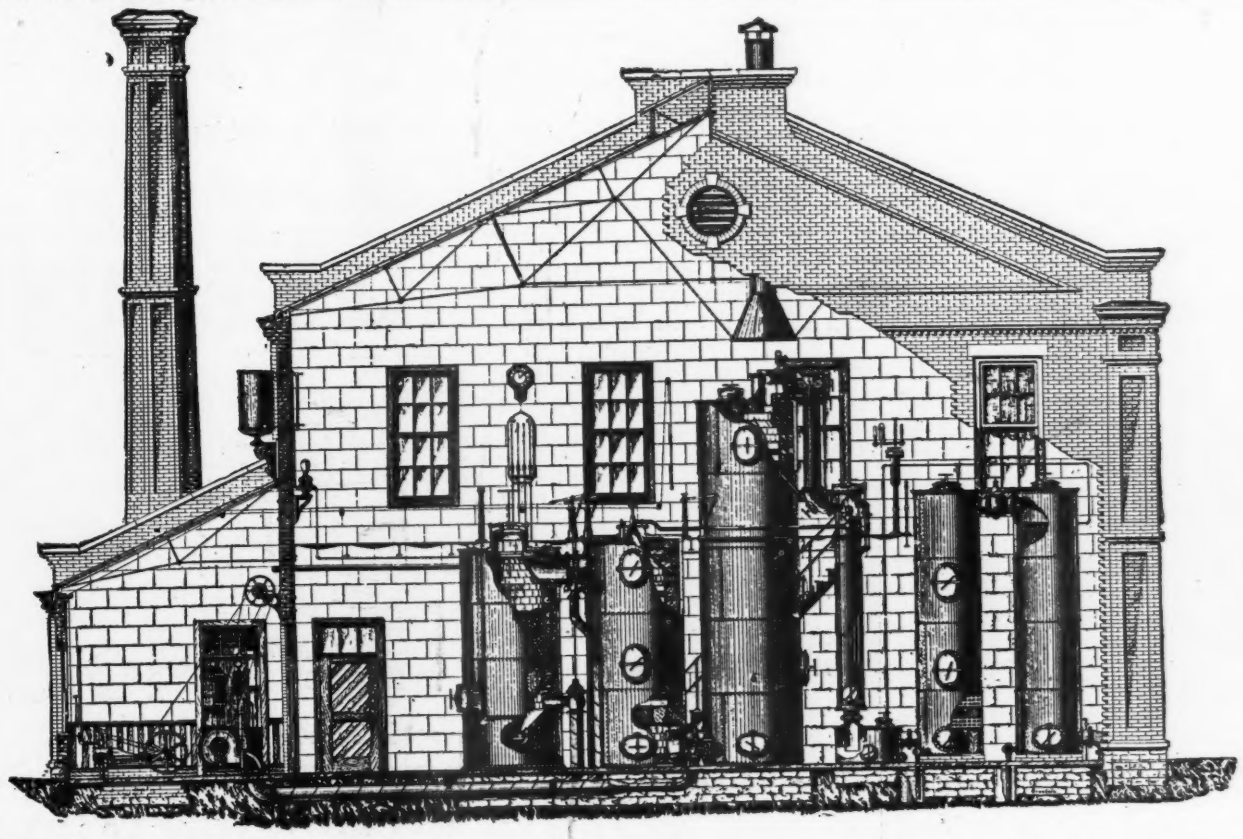

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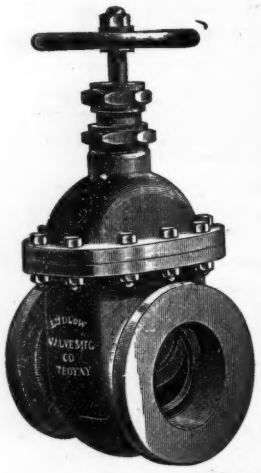

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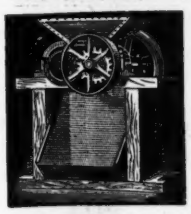

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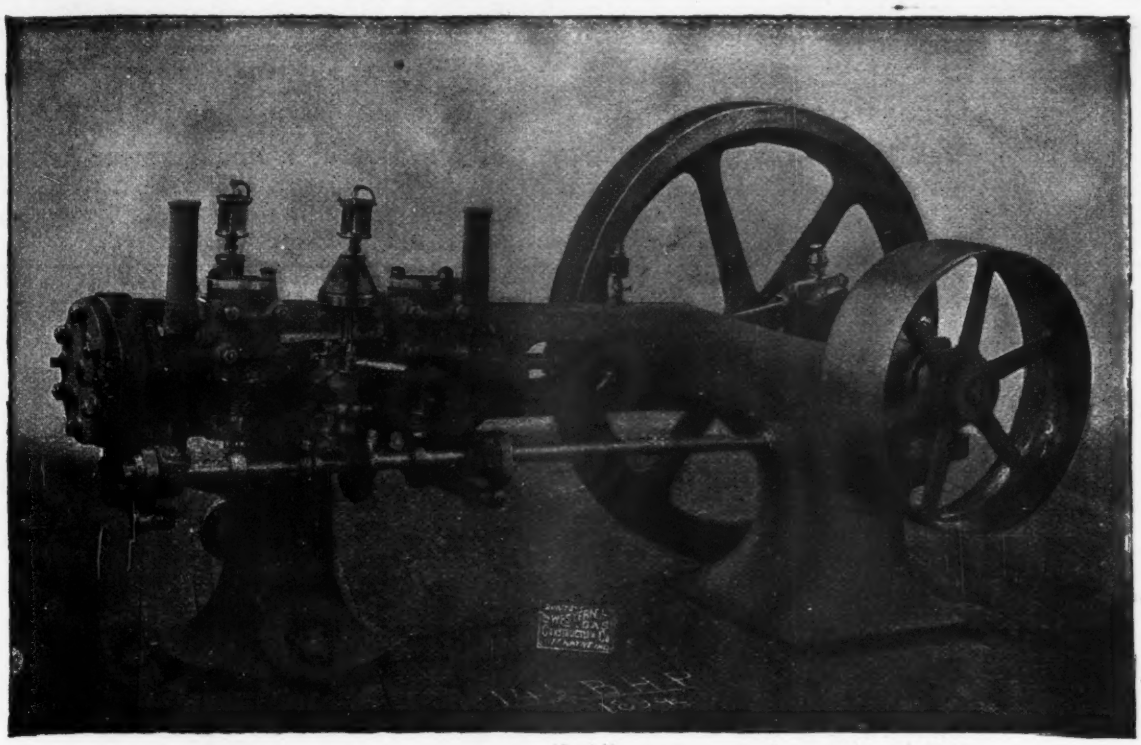

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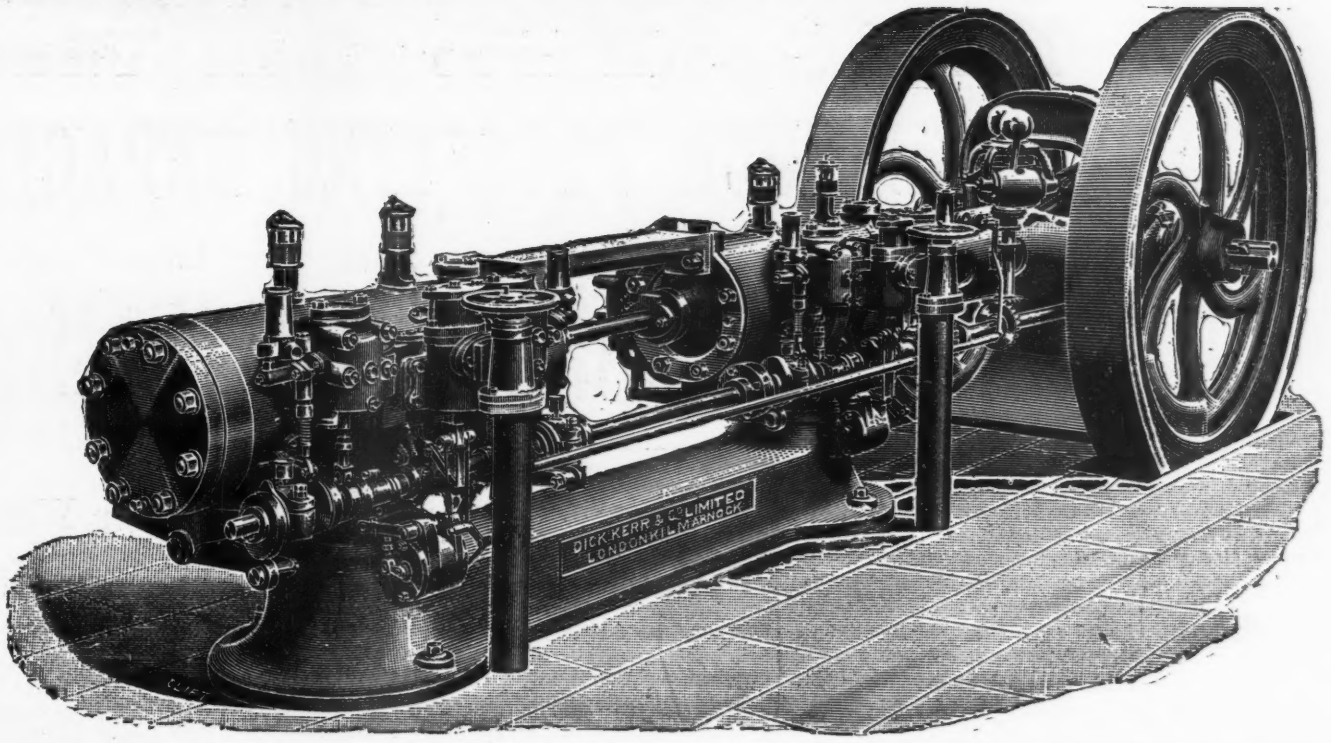

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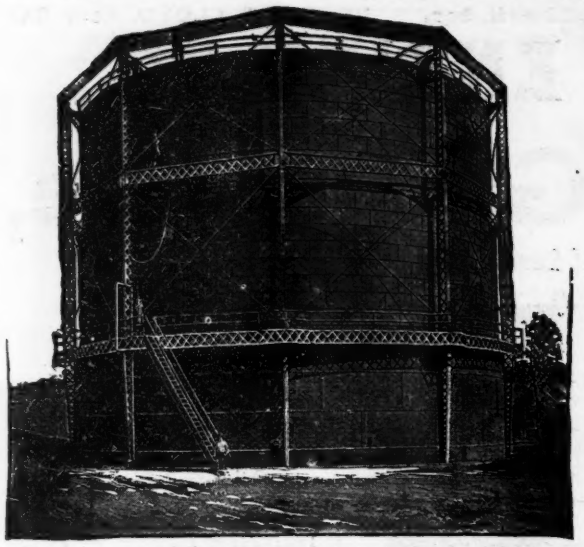

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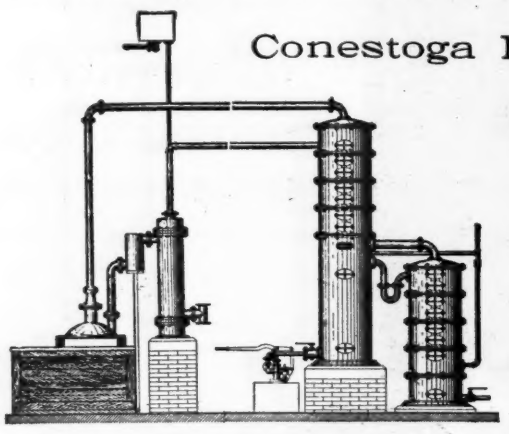

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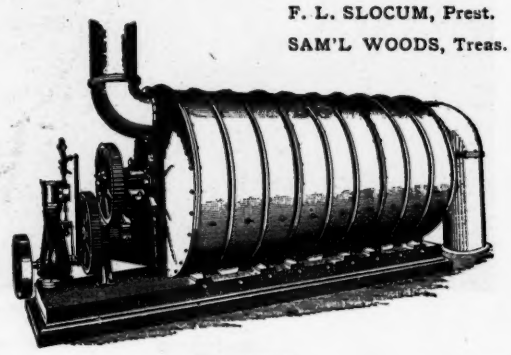

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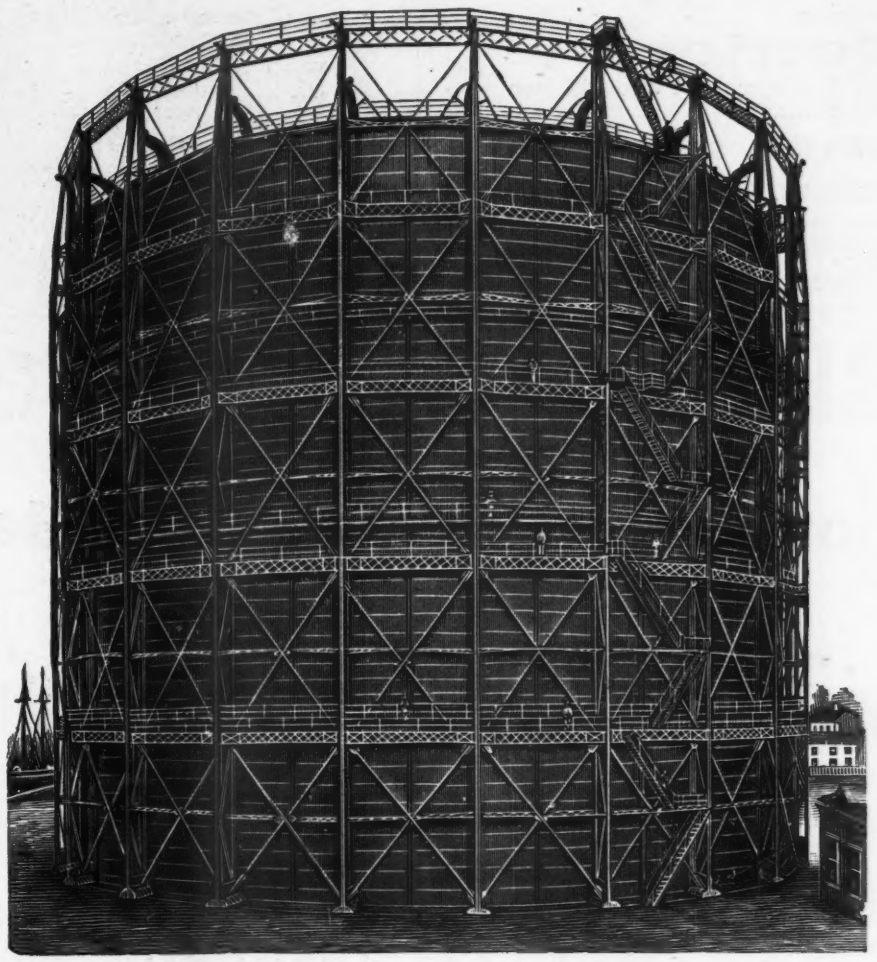

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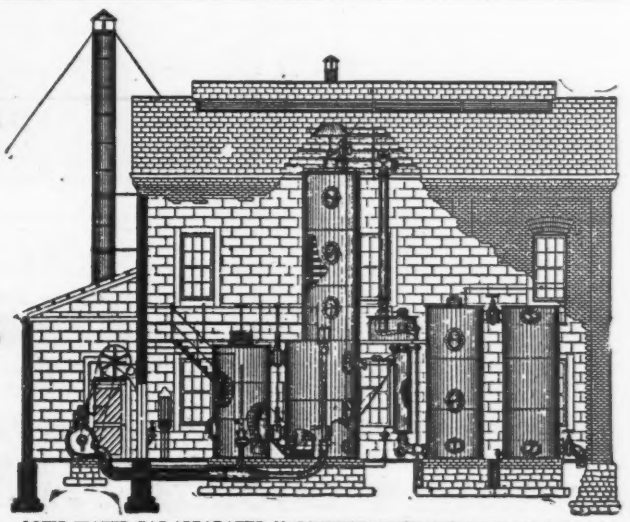

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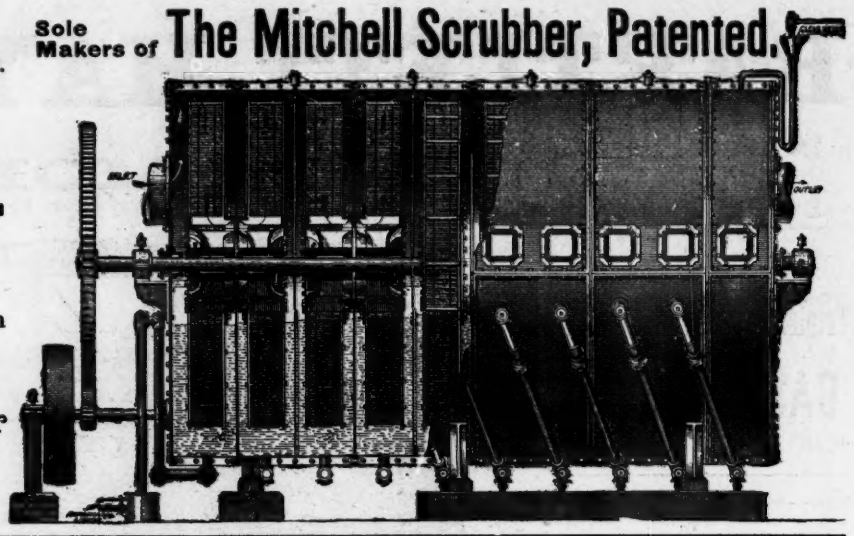

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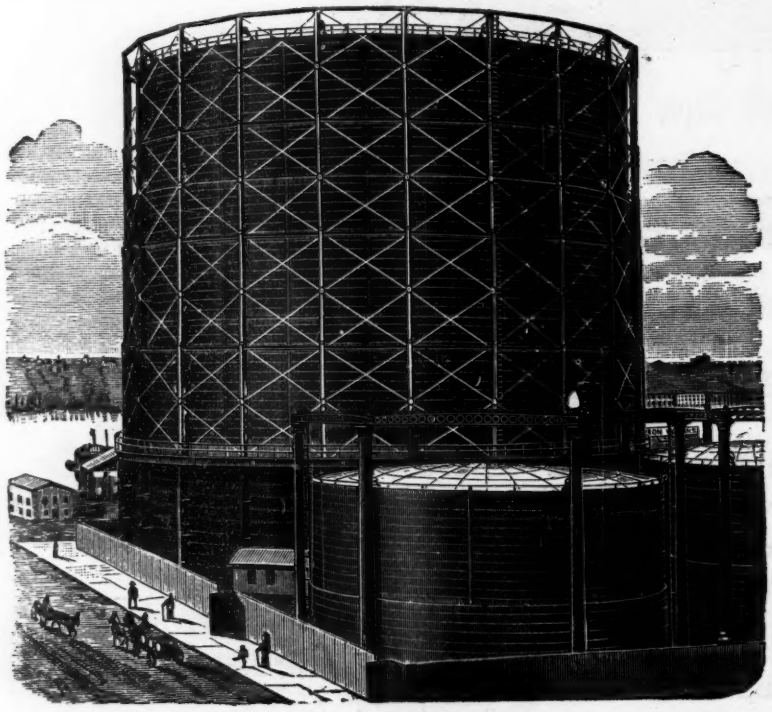

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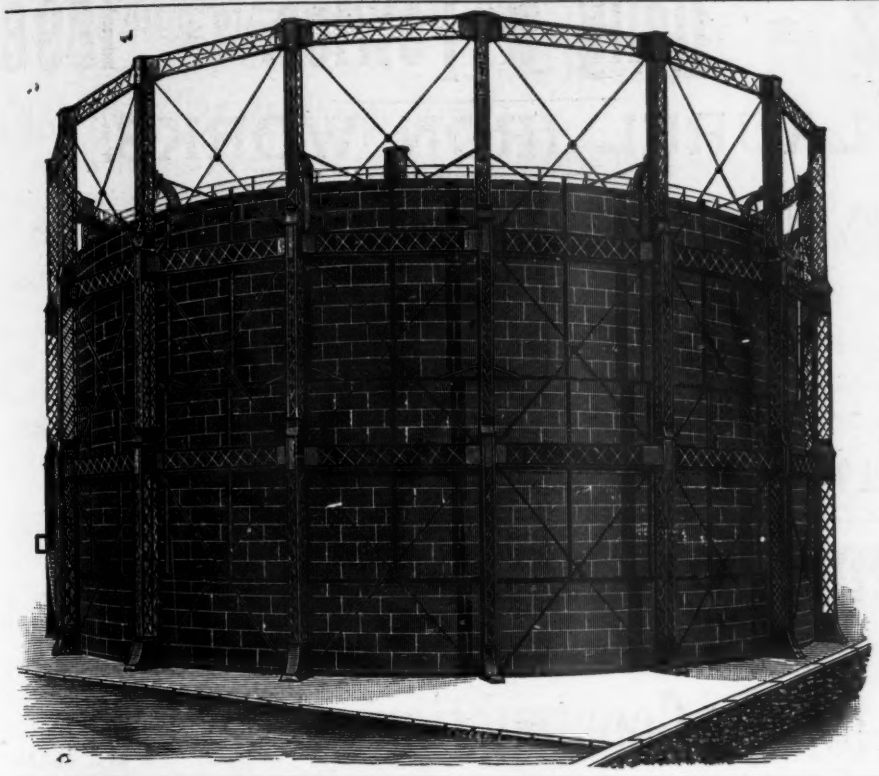

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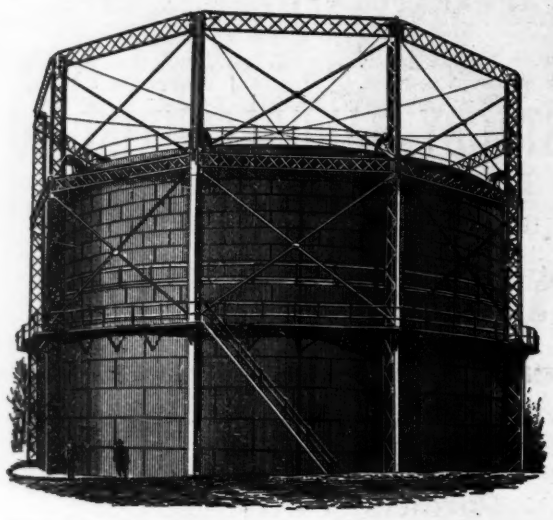

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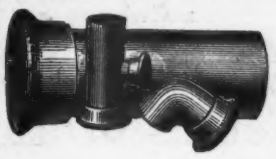

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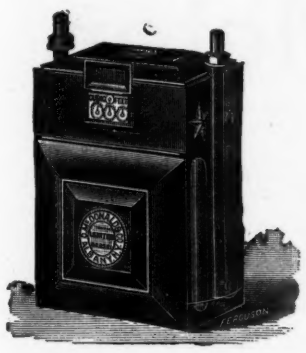

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